

Conserving Biological Diversity

A Strategy for Protected Areas in the Asia-Pacific Region

Susan Braatz

in collaboration with Gloria Davis, Susan Shen, and Colin Rees



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Foreword

Loss of biological diversity through the extinction of species, the conversion and degradation of natural habitats, and the disruption of ecological processes, is occurring throughout the world at an unprecedented rate. As species and their habitats disappear, so do products of present and future value, genes with which to improve crop varieties and livestock, and the natural resiliencies of the world's living resources to respond to climatic and environmental change. Nowhere else is the loss of biodiversity expected to be higher during the coming decades than in the Asia-Pacific region.

The loss of biodiversity is irreversible. Recognizing this, the Asia Environment Division of the World Bank has prepared a paper intended to identify priority areas for investment in the Asia-Pacific region. The paper accepts the importance of biodiversity conservation and suggests that policy change coupled with the establishment of protected area systems will be critical to success. A wide range of interventions will be needed to support these efforts toward conserving biodiversity—interventions involving national and local governments, national and international nongovernmental organizations and, most importantly, local people. Nearly all countries

require institutional strengthening, particularly in staff training and effective staff deployment, and there is an urgent need to establish funding mechanisms to sustain the management of protected areas. In addition, it will be critical in the immediate future to enlist local communities in the conservation of biological diversity and to demonstrate that this can be achieved on a scale commensurate with current threats.

Clearly, both public awareness and political commitment are necessary for building a sustainable level of development that does not deplete the biological resources on which it depends. Toward that goal, the strategy defined in this paper is intended to complement existing national and international initiatives and to build partnerships in conservation for the 1990s. It is also intended to demonstrate the commitment of the World Bank to the conservation of biological resources and to the support of those engaged in such critical work.



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Director
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Abbreviations, Acronyms, and Data Notes

AWB	Asian Wetland Bureau
BAPPENAS	National Development Planning Bureau (Indonesia)
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CITES	Convention on International Trade in Endangered Species
CNPPA	Commission on National Parks and Protected Areas
EAP	Environmental Action Plan
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
IBPGR	International Board on Plant Genetic Resources
ICBP	International Council for Bird Preservation
ICDP	Integrated Conservation and Development Projects
IPAS	Integrated Protected Area System
IRRI	International Rice Research Institute
IUCN	International Union for Conservation of Nature and Natural Resources
IWRB	International Waterfowl and Wetlands Research Bureau
MAB	Man and Biosphere Program (Unesco)
NGO	Nongovernmental organization
SECAL	Sector Adjustment Loan
SPREP	South Pacific Regional Environmental Programme
TDRI	Thailand Development Research Institute
TFAP	Tropical Forest Action Plan
TRAFFIC	Trade Records Analysis of Flora and Fauna in Commerce
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
Unesco	United Nations Educational, Scientific, and Cultural Organization
USAID	United States Agency for International Development
WCMC	World Conservation Monitoring Centre
WRI	World Resources Institute
WWF	World Wildlife Fund

Data notes

Billion is 1,000 million.

Dollars is U.S. dollars.

The budget figures for Tables 9 and 10 were obtained in local currency figures. To convert to the U.S. dollar equivalent, exchange rates from the *International Financial Statistics 1990* (International Monetary Fund 1990) were used. The U.S. dollar equivalent was then divided by the country's GNP for 1988, the figure for which was obtained from *Trends in Developing Countries* (World Bank 1989), to derive the percentage of GNP that goes to conservation.

Executive Summary

This strategy paper accepts the position that setting up comprehensive and well-managed protected area systems is likely to be the most practical way to preserve the greatest amount of the world's biological diversity and the ecological processes that define and mold it. For this reason, it suggests that initial efforts should help support the establishment and maintenance of protected area systems by promoting policy change, incorporating local people into protected area management, and mobilizing financial resources for conservation and protection.

Status and Trends in the Asia-Pacific Region

Biological diversity, or biodiversity, encompasses the variety and abundance of plants, animals, and microorganisms as well as the ecosystems and ecological processes to which they belong.

The Asia-Pacific region is marked by great geographic and biological diversity. It includes the world's highest mountain system, the second largest rainforest complex, more than half of the world's coral reefs, and tens of thousands of diverse island systems. The region encompasses segments of three of the world's eight biogeographic divisions, as well as the Indian and the Pacific oceans. These characteristics account for tremendous species diversity and high levels of endemism.

Pressure on the region's biological diversity is intense, stemming from rapidly increasing populations (60 million annually) and demands for economic growth. Asia is the world's most populated region, with 13 percent of the earth's land area and 50 percent of its people, and it includes some of the world's poorest countries. More people live in poverty in Asia than in Africa and Latin America combined. Although it is by no means clear whether poverty, with its pressures to sur-

vive, or affluence, with its pressures to consume, ultimately leads to greater environmental degradation, it is obvious that poor people cannot conserve natural resources if this is in conflict with their immediate survival needs. The greatest challenge then is to reconcile people's needs with national and global interests in conservation.

In Asia, as elsewhere, biodiversity loss is caused by habitat destruction from clearing and burning forests, logging and agricultural encroachment, draining and filling wetlands, destroying coastal areas for development, and converting natural ecosystems for agriculture, industry, and human settlement. South and Southeast Asia together have lost about 67 percent of their original wildlife habitat. This includes the loss of about two-thirds of forest areas and over half of wetlands, mangroves, and grasslands. Only the island of New Guinea (Irian Jaya and Papua New Guinea) has large expanses of relatively undisturbed habitat under little immediate threat. Poaching, hunting, collection of valuable plants, introduction of exotic species, and pollution also pose major threats to many wildlife species and natural habitats.

Biodiversity Conservation in the Region

Basic knowledge of conservation needs in the Asia-Pacific region is fairly extensive. Biological surveys and natural area assessments of the existing protected area systems have been carried out in most Asian countries to identify sites of biological significance and priorities for conservation. These provide sufficient information on which to base efforts to strengthen national conservation systems. Information is seriously lacking only in Papua New Guinea, the Maldives, and Cambodia, and is not easily accessible for China. Various regional studies by international nongovern-

mental organizations (NGOs) provide, or will soon provide, lists of sites of regional or global importance for conservation that will be useful in further defining priorities.

Status of Protected Areas. Protected areas are obvious sites for conserving biodiversity, and many countries in the region have made substantial efforts over the last two decades to improve their protected area systems. Nonetheless, the protection of biological diversity in the region is weak, particularly in the Pacific island nations. Although 3.8 percent of Asia's total land area is designated as protected areas, a proportion equal to the world average, many habitats are unrepresented or under-represented. Even countries with extensive systems have gaps in coverage, and protection of wetlands and marine areas is especially limited. While some countries have quite extensive protected area systems either in absolute size (China, Indonesia, and India) or in proportion to their total land area (Kiribati, Bhutan, Sri Lanka, and Thailand), a number of countries in the region have very weak systems or none at all (Lao People's Democratic Republic, Cambodia, the Maldives, the Solomon Islands, and Vanuatu).

Another more serious problem is that many of the areas in the region designated as protected areas are not adequately managed. A large number are "paper parks," which although protected by law, are unprotected, unmanaged, and lacking in park infrastructure and on-site staff. Some have been so degraded and their biological diversity so depleted, that they are no longer worth designation as parks.

Factors in Protected Area Management. Regardless of the comprehensiveness of a country's protected area system, biological diversity cannot be preserved unless there are adequate legal and institutional structures capable of managing the protected areas. The paper discusses the essential elements of sound conservation.

Legal Framework. Although all governments, with the exception of Cambodia, Lao P.D.R., and the Maldives, have basic legislation related to wildlife protection and the establishment of conservation areas, much of it is weak and is focused on particular species or types of organisms rather than on habitats. A more critical problem is that enforcement of conservation legislation is poor,

and illegal hunting of wildlife, logging, and agricultural encroachment in parks and protected areas are common. Also, membership in international conventions and treaties concerning biodiversity conservation is relatively low, particularly among the Pacific island nations.

Institutional Structures. Conservation in many countries is limited by administrative structures. Generally, the responsibility for conservation resides with the Forestry Department where priorities have traditionally been on production, not protection. Most institutions are overcentralized and relate poorly to local governments. In addition, political support for conservation often is limited; thus the institutions lack the necessary authority to carry out their responsibilities effectively and low morale becomes a problem.

Financial Resources. Existing government expenditures are inadequate to assure the long-term survival of protected areas. Although estimates are difficult to verify, direct expenditures range from \$30 million to \$35 million annually, most of which is for acquisition of lands, preparation of management plans, and capital expenditures for infrastructure. Funds are severely limited for operation of the protected areas, including staff salaries, administrative costs, maintenance, law enforcement, education, research, and monitoring. It is estimated that a tenfold increase in the current levels of investment is required to establish and maintain a system sufficient for conserving biodiversity, and that a minimum of \$100 million per year is needed to cover only the recurring expenses of protected areas. Since many countries in the region do not have the absorptive capacity to effectively handle a large influx of capital, slow sustained funding will be needed.

Human Resources. One of the most critical problems facing conservation agencies in Asia is the lack of well-trained staff, including field staff, mid-level managers, and top-level conservation planners and administrators. This is particularly acute in Bhutan, China, Indonesia, Nepal, the Philippines, and Sri Lanka, countries with relatively well-developed systems that need improved management. It is also a serious bottleneck for countries that wish to establish protected area systems, such as Lao P.D.R., Papua New Guinea, Viet Nam, and the Pacific island

nations. Thus, there is a critical need to develop conservation training programs in the Asia-Pacific region, including in-service training for field staff, graduate and post-graduate training for mid- and upper-level staff, and training of conservation educators. Training is needed not only in the more traditional conservation subjects, but also in working effectively with local communities.

The Role of NGOs. Nongovernmental organizations contribute to biodiversity conservation by playing an advocacy role, implementing projects, encouraging local support and participation, and mobilizing financial resources from the international donor community. However, only a few Asian countries (India, Nepal, the Philippines, Sri Lanka, and Thailand) have large NGO communities, and relatively few NGOs are involved in conservation. Strengthening local and national NGOs in the region, therefore, will be an important step in making links between conservation and the needs of local communities and increasing national capabilities and absorptive capacities.

Political Commitment. Throughout Asia, government commitment varies widely, and there appears to be little correlation between a country's ability and its willingness to pay for conservation. For example, Bhutan, one of the poorest countries in the region, has devoted more than 0.2 percent of total public expenditures to biodiversity conservation. Another indicator of commitment is membership in international conservation conventions. India, Nepal, Pakistan, Sri Lanka, and Viet Nam are active members in such organizations, but generally Asian participation in these efforts has been limited.

Key Elements in Biodiversity Conservation

This paper focusses on three elements that are critical to conservation programs.

Improving the Policy Environment. A wide range of policies, laws, and regulations result directly or indirectly in the depletion of biodiversity or work at cross-purposes to its conservation. These "perverse" policies include economic and fiscal policies such as land ownership and resource tenure policies, and sectoral policies in agriculture, forestry, fisheries, energy, and indus-

try. One of the policies that negatively affects biodiversity is the transfer of forest land to public ownership, leading to the breakdown of traditional regulation under customary law. This is further compounded by the inability of most Asian governments to enforce forestry regulations. Forestry policies that promote wood extraction and wood processing industries, may result in more logging and wasteful and destructive practices. Agricultural policies may accelerate the conversion of forests, rangelands, and wetlands to agriculture, and encourage the overuse or misuse of pesticides and fertilizers. Development policies may allow levels of effluents from power plants and industries that adversely affect aquatic ecosystems.

Integrating Conservation and Development. Enforcement is unlikely to be a long-term solution to the protection of parks and reserves, particularly in poor and densely populated areas. Consequently, the successful management of protected areas will depend ultimately on the cooperation and support of local people. It is not justifiable to ask communities within or adjacent to a conservation area to bear the costs of protection without providing adequate alternative means of livelihood.

However, despite discussion for at least a decade, there have been few initiatives to reconcile the needs of local people with conservation. Integrated conservation and development projects (ICDPs) are still experimental, and most have been small and highly dependent on external resources. Promoting these activities on a larger scale will be necessary.

Women are critical to biodiversity protection in developing countries. They often do most of the work of gathering medicines, firewood, and growing subsistence crops. Because women typically make economic use of a wider range of products than men, they have a greater interest in sustaining biological resources. Accordingly, the participation of women in planning and implementing projects that involve natural resources will be a necessary step in biodiversity conservation.

Mobilizing Financial Resources. A number of options exist to increase financing for biodiversity conservation. Most important are those intended to mobilize resources domestically, such as taxes and levies on natural resource usage,

tapping revenue streams from development projects that have an impact on biodiversity, or charges for private sector use (tourism and genetic property rights, for example). New channels for international assistance (for example, trust funds and endowments) will also be important. Although experience with these mechanisms is limited in the region, the paper highlights some of their benefits and risks.

The World Bank and Biodiversity Conservation

The Wildlands Operational Note and the Environmental Assessment Operational Directive provide the framework for World Bank support of biodiversity conservation. In addition, the recent Bank publications *The Forest Sector* (1991) and *Strategy for Forest Sector Development in Asia* (1992b) reflect expanded emphasis on conservation in tropical forests.

Developing biodiversity conservation components in investment projects has been supported by the Technical Assistance Grant Program for the Environment, by funds from the Japanese and Norwegian governments, and most recently, by the Global Environment Facility (GEF). These facilities provide funds for preparation activities and, in the case of the GEF, will finance investment activities in biodiversity conservation.

The GEF is a pilot program to help developing countries address global environmental problems. Since the first GEF proposals in December 1990, governments, implementing agencies, and NGOs have proposed a wide variety of projects related to biodiversity protection. To date, thirteen biodiversity proposals for the Asia-Pacific region, totalling over \$100 million have been provisionally accepted or are under review. If this pipeline develops as expected, there will be at least one biodiversity initiative supported by the GEF in most countries in the region.

Other biodiversity activities currently under way in the Asia-Pacific region with World Bank support, involve establishing and maintaining protected areas as components of larger agricultural and natural resource projects. The project components include compiling biological inventories and databases, developing training programs, preparing management plans and providing infrastructure for specific protected areas. The components also include studies of needed policy changes and guidance on the establishment of buffer zones and new financing mechanisms.

A Regional Strategy for Biodiversity Conservation

Programs and Country Priorities. Since every country in the region has protected areas of international significance, most of which are under threat, and since virtually all countries require additional technical and financial support to conserve their biological resources, national programs will need to be supported in all countries of the region. However, a regional strategy must give highest priority to the countries with the greatest wealth of diversity (Indonesia, China, India, Malaysia, Papua New Guinea, and the Philippines). It should also give priority to those with high numbers of species or endemics per unit area (Bhutan, Nepal, Sri Lanka, and the Pacific island nations of Fiji and Solomon Islands). Secondary emphasis should be given to the countries of Indochina that have moderate species richness and endemism but substantial natural habitat under threat (Cambodia, Lao P.D.R., Myanmar, and Thailand).

Where sites of worldwide significance are identified, a major effort should be made to protect them; however, in Asia the focus needs to be on developing and maintaining systems rather than single sites. Investment in the region would generally be more effective through conservation measures that have an impact beyond protected areas. Such measures include supporting policy change, promoting linkages between small-holder development and conservation, mobilizing financial resources, strengthening institutional capacity, and developing model projects.

Demonstration Effects. Of these wide-ranging conservation measures, three have been identified as critical for protecting biodiversity in the Asia-Pacific region: modifying policies that have adverse impacts on biodiversity; demonstrating new ways of reconciling the needs of local people with the need to protect areas; and ensuring the sustainability of investments through domestic resource mobilization. The Bank can help by designing projects demonstrating new approaches to these issues.

Analytical Work. Environmental action plans and other country and economic sector studies will be essential to analyzing the policy forces behind biodiversity loss, to identifying specific reforms for reducing the threat or creating incentives to conserve, and to mobilizing

public support for protection. There is also an urgent need to establish or strengthen in-country biodiversity databases for analysis of conditions and trends and use in decisionmaking.

Gaps. To date, attempts to conserve biodiversity have concentrated on promoting comprehensive protected area systems. However, parallel efforts should be made to conserve biodiversity in the context of agricultural and other landuse activities. A study of how *ex-situ* methods can best support biodiversity conservation in protected areas also would be useful.

Concerted efforts by governments and local and international NGOs are also needed to increase public awareness of the importance and value of biodiversity. To enhance these efforts, it will be essential to strengthen developing country NGOs and promote their participation in biodiversity policymaking and planning.

A regional strategy is needed to protect wetlands and marine ecosystems, and also a subre-

gional strategy is needed for the mainland southeast Asian countries of Cambodia, Lao P.D.R., Myanmar, and Viet Nam, taking into account their ecological conditions and stage of economic development.

The Bank's Role. Given its comparative advantage in policy analysis and sector work, the Bank can contribute to biodiversity protection through country and economic sector studies and through national biodiversity action plans. The Bank is also well placed to support efforts to reconcile people's needs with conservation. A foundation has been laid by the early ICDPs, which should be expanded where there is the greatest potential for success. Further projects should strengthen the institutions required, ensure that the policy and legal environment is favorable, provide long-term funding, and promote popular awareness and support for conservation initiatives. The GEF can play a supportive role for these endeavors.

Introduction



Unless immediate, decisive steps are taken to counter the effects of deforestation and other forms of natural resource destruction in the Asia-Pacific region, much of Asia's biodiversity will be irreversibly lost within this generation. Most of these losses will take place in species-rich lowland tropical rainforests, few of which are expected to remain undisturbed, other than those in protected areas. But losses will also be high in many of the region's dry forests and grasslands, as well as in freshwater, coastal, and marine ecosystems. Over the next quarter of a century, the Asia-Pacific region is expected to lose a higher proportion of its species than any other part of the world.

The objective of this strategy paper is to identify the countries and areas in the Asia-Pacific region that should receive priority for the conservation of biodiversity, taking into account the value of their biological diversity and the urgency for their protection (the degree of threat and the existing level of protection). The paper focuses on actions required to protect a large representative sample of the region's natural habitat, on the assumption that habitat conservation will be the most effective means to protect most species, genetic variability, and ecological diversity and processes. In proposing the strategy, the paper indicates which countries have demonstrated political commitment to conservation and have built institutional capabilities, and identifies actions needed to strengthen institutional frameworks for conservation. It also discusses issues related to the financing and management of protected areas in the region and describes policies that have had adverse impacts on biodiversity in general. Finally, the report discusses the role of the World Bank in supporting conservation efforts in the region and outlines a regional strategy for conserving biological diversity, particularly in protected areas.

The Nature of Biodiversity

Biological diversity, or biodiversity, encompasses the variety and abundance of plants, animals, and microorganisms as well as the ecosystems and ecological processes to which they belong. Biodiversity is usually considered at three levels: genetic, species, and ecosystem diversity. Genetic diversity is the total genetic information contained in the genes of individual organisms. Species diversity refers to the variety of living organisms. Ecosystem diversity relates to the enormous diversity of habitats and biotic communities, as well as to the variety of ecological processes within ecosystems (McNeely and others 1990).

Remarkably little is known about species diversity in quantitative terms. Estimates of the total number of species on earth range from 2 million to 100 million, of which less than 1.5 million have been named, and only a small fraction of these have been considered for their economic value (Reid 1992). Reid and Miller (1989), among others, have estimated that 5 to 10 percent of these species are presently being lost each decade, a rate not seen since the dinosaurs died out 65 million years ago. Population growth and climatic changes could accelerate such extinctions even beyond these figures.

The Significance of Biodiversity

Economic Benefits. The most politically appealing and economically attractive argument in favor of maintaining biodiversity is that it provides enormous direct economic benefits in the form of food, medicines, and industrial raw materials, and has the potential for generating many more (Ehrlich and Wilson 1991; McNeely 1988).¹ Thus, tropical forests produce timber, as

well as an extraordinary range of plant and animal products that do not, for the most part, pass through formal economic markets (de Beer and McDermott 1989). The genetic richness of wild plants is indispensable for developing new agricultural and medicinal varieties. In addition, many countries earn substantial foreign exchange from natural ecosystems with touristic values. These direct economic values of biodiversity are, conceptually at least, rather easy to quantify and value, even though relevant scientific and economic data are lacking in all but a handful of examples.

Services to Humanity. Biodiversity supplies the working ingredients for natural ecosystems that provide an array of essential services to humanity: keeping the air clean, modifying climatic extremes, degrading wastes, recycling nutrients, creating soils, controlling diseases, regulating hydrological cycles, and so on (see Box 1). Although these services have yet to be systematically evaluated and quantified, they are clearly basic to economic growth and development; and scientists and conservationists fear that destruction of natural ecosystems and their associated species may in the long run undermine the earth's ability to support diverse forms of life, including human life.

Ethical and Aesthetic Justifications. Despite the fact that they are the least quantifiable, for many people ethical and aesthetic arguments in favor of biodiversity conservation are the most compelling of all. The ethical viewpoint is that plants and animals have an intrinsic value that is independent of their value for humanity and, therefore, that monetary valuations are not the most appropriate criteria on which to base biodiversity conservation decisions. The aesthetic justification is that many species of wild plants and animals, and the ecosystems of which they are integral parts, are a source of irreplaceable wonder, spirituality, and inspiration to humanity (Ledec and Goodland 1988).

The Decline of Biodiversity

In Asia, as elsewhere, the most important direct cause of biodiversity loss is habitat destruction from clearing and burning forests, draining and filling wetlands, destroying coastal areas for development, and converting natural ecosystems for agriculture, industry, and human settlement.

Box 1. Functions and Benefits of Natural Ecosystems

- Photosynthetic fixation of solar energy and transference to natural food chains.
- Regulation of water cycles, including recharging groundwater, protecting watersheds, and buffering the effects of floods and droughts.
- Regulation of climate at macro- and micro-levels, including influences on temperature, precipitation, and air turbulence.
- Production of soils and protection of soils from erosion.
- Storage and cycling of essential nutrients—especially nitrogen, and maintenance of the gaseous composition of the atmosphere, including the oxygen-carbon dioxide balance.
- Absorption and breakdown of pollutants, including the decomposition of organic wastes, pesticides, and air and water contaminants.
- Preservation of species critical to pollination, pest control, gene flow, cross-fertilization, and maintenance of evolutionary processes.
- Direct benefits to humanity—for food, medicines, and industrial raw materials.

Source: Adapted from McNeely 1988 and Ehrlich and Wilson 1991.

Other reasons for loss include the overexploitation of plants and animals, invasion by introduced species, air and water pollution, and the prospect of climate change. Ultimately, however, the current threat to biodiversity results from a complex variety of underlying social, economic, political, and cultural forces and trends operating on local, national, and international scales. These influences are so complex that it is probably not an overstatement to refer to them as being "rooted in the contemporary human condition" (Soulé 1991). Economic externalities, adverse government policies, human population growth, and poverty are among the most powerful of these influences, and these factors are themselves strongly interconnected.

Rapid population growth is often cited as the basic cause of habitat destruction, with accompanying loss of biodiversity. This is of fundamental importance in Asia, where 13 percent of the world's land area supports 50 percent of the

world's population, and where 60 million people are added to the region's population each year (Appendix Table A.1). But the relationship between population growth and environmental degradation is complex and variable. It is clearly mediated by social, economic, and institutional factors that influence how people use natural resources as well as by the technologies employed.

Poverty is a second factor affecting biodiversity loss in the Asia-Pacific region. Although it is by no means clear whether poverty, with its pressures to survive, or affluence, with its pressures to consume, ultimately leads to greater environmental degradation, it does seem clear that poor people will not, indeed, cannot, conserve biodiversity if this requires looking beyond their immediate needs. Those in poverty have limited access to resources and few income-generating opportunities, and usually their living conditions are affected by laws, policies, social changes, and economic forces over which they have little or no control.

Poorly conceived and inconsistent governmental policies are another root cause of biodiversity loss. For example, one governmental agency may be charged with halting deforestation, while another attempts to encourage crop exports by subsidizing farmers to clear land (WRI 1992). Policies that award titles to settlers or ranchers to "improve" land by clear cutting forests generally lead to the loss of biodiversity, as do modern land laws that destroy the community property systems of the few remaining hunting and gathering societies. Furthermore, the activities and policies of industrial countries and multinational companies may ultimately cause as much, if not more, of the biodiversity loss in developing countries as do factors originating within the countries themselves (Stone and Hamilton 1991).

Market forces tend to undermine biodiversity by undervaluing the use of environmental resources, whether by the poor or the rich. Indeed, biodiversity is almost totally ignored in national economic accounts because of the difficulty of placing an exact value on the services it provides (Repetto and others 1989). Furthermore, there is often a basic conflict between private resource use and long-term social and environmental goals. Private costs and benefits guide the decisions made by the users of natural resources, but the costs of that resource use are frequently borne by someone other than the user, often by society

as a whole. Because of this conflict, the socially desired outcome—conservation of ecosystems yielding valuable services to humanity—will not be reached by the operation of market forces that depend on private values. The promise of long-term economic benefits to countries and the international community can appear abstract to the people, politicians, and corporations who are more concerned with short-term economic gains, particularly where poverty is widespread. Even wealthy countries continue to justify the conversion and degradation of their natural areas to satisfy short-term economic interests. Until economic systems take into account the value of biodiversity, these conflicts will remain.

Frameworks for Biodiversity Conservation

The arguments in favor of slowing habitat and biodiversity loss are powerful, but they provide little guidance on how much biodiversity should be conserved, where it should be conserved, and what alternatives are worth pursuing. However, a number of documents and conventions have laid the basis for such prioritization. Several of the most important recent initiatives are discussed here.

The *Global Biodiversity Strategy*, published in February 1992, is an internationally sponsored attempt to clarify some of the issues. This document was developed by more than 500 scientists, community leaders, and representatives of government and industry from around the world, who were brought together under the auspices of the World Resources Institute (WRI), the International Union for Conservation of Nature and Natural Resources (IUCN), and the United Nations Environment Programme (UNEP), in collaboration with the Food and Agriculture Organization (FAO) and the United Nations Educational, Scientific, and Cultural Organization (Unesco). The Strategy indicates that the goal of biodiversity conservation is to support sustainable development by protecting and using biological resources in ways that do not diminish the world's variety of genes and species or destroy critical habitats. It sets forth basic principles to guide biodiversity planning at local, national, and international levels over the next decade, and suggests actions that could postpone a species-extinction crisis and stabilize key genetic resources. Locally, the strategy calls for community organizations, local governments, and other traditional users of natural resources (such as

Box 2. Major Conservation Conventions and Agreements

The Man and the Biosphere Program (1970). MAB is a long-term program on research, training, and information exchange among states concerning environmental management; it was organized by the Unesco General Conference in November 1970. The program provides for the protection and scientific study of a global network of biosphere reserves. Research focuses on the relationship between conservation and sustainable use of natural resources.

The Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar 1971). Contracting parties undertake to use wisely all wetland resources under their jurisdiction and to designate for conservation at least one wetland of international importance under criteria provided by the Convention. By 1990, the 61 contracting states had designated over 421 sites covering more than 300,000 square kilometers. Nations facing economic constraints have had difficulty in meeting their obligations. As a consequence, in 1990 parties voted to establish a Wetland Conservation Fund, built on mandatory and voluntary contributions, with an annual budget of approximately \$660,000. Parties meet at least every three years, and the Secretariat is provided by IUCN.

The Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris 1972). The Convention, in force since 1975, recognizes the obligation of all states to protect unique natural and cultural areas and recognizes the obligation of the international community to help pay for them. A World Heritage Committee, drawn from the 111 State Parties, establishes and publishes the World Heritage List of sites of exceptional cultural or natural value; as of January 1991, 337 sites were on the list, of which only 79 are natural, and a further 13 combine both natural and cultural values. Each party must contribute to a fund to support these sites and related research; contributions are set at 1 percent of contributions to the annual budget of Unesco, currently totalling approximately \$2 million. The "List of World Heritage in Danger" covers sites threatened by serious and specific dangers. Its Secretariat is provided by Unesco.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington 1973). The Convention (CITES) has been in force since 1975 and is currently ratified by 111 States; it establishes lists of endangered species for which international commercial trade is either prohibited or regulated via permit systems to combat illegal trade and over-exploitation (see Box 3). Inclusion of species in the most restrictive categories requires a two-thirds majority of the Parties to the Convention; the least restrictive inclusions may be made by a single party. A Conference of Parties (at which NGOs have been well-represented) is held every two years. The Convention has financed population studies of particular species to attempt to curb further endangerment. National management and scientific

authorities must be designated by each state to grant and review the Convention permits; records of permits granted are supposed to be sent annually to the Convention Secretariat for review (though many parties are not complying with this provision). The Secretariat is provided by UNEP.

The Convention on the Conservation of Migratory Species of Wild Animals (Bonn 1979). The Convention, in force since 1983, obligates parties to protect endangered migratory species and to try to conclude international conservation agreements for vulnerable species that are not yet endangered. No such agreements have come into force, but several are likely to be implemented by the mid-1990s. The thirty-six contracting parties do not yet include several countries of major importance for migratory birds. Some fifty-one migratory species are listed as "endangered" by the Convention, including four species of whales, several species of antelopes, twenty-four bird species, and six marine turtles. The Convention precludes commercial taking of listed species; it also encourages member states to conserve and restore habitat areas for migratory species. The Secretariat is provided by UNEP.

The FAO International Undertaking on Plant Genetic Resources (Rome 1983). This voluntary agreement among nations is based on the principle that plant genetic resources are the common heritage of humankind. A Commission on Plant Genetic Resources was also established in 1983 to pursue actions pursuant to the International Undertaking. At its 1987 meeting, the Commission established an International Fund for the Conservation and Utilization of Plant Genetic Resources, based on voluntary contributions. The Undertaking initially attempted to ensure the full exchange of genetic resources (including breeding lines in finished varieties). However, at the 1987 meeting of the Commission, the right of plant breeders to protect their breeding lines was recognized, as were "Farmers Rights" to compensation for their contribution to the selection and conservation of genetic diversity of crops and livestock. As of 1991, 111 countries are members of the Commission and 101 have adhered to the International Undertaking. The Secretariat for the Commission is housed at FAO.

Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (Noumea 1986). The Noumea Convention, as a UNEP Regional Seas Convention, promotes regional cooperation in the environmental protection and natural resources management of marine and coastal areas. The signatories recognize the economic and social value of natural resources in the region, while addressing the threats to the marine environment and ecological equilibrium that are posed by pollution and development. The Convention was enforced in 1990.

Source: WRI/IUCN/UNEP 1992.

women and indigenous people) to participate in decision-making and biodiversity protection. It urges national biodiversity action plans, policy reforms, better management, and more investment in biodiversity conservation. At the international level, the strategy calls for the adoption of a convention on biodiversity as well as other conservation agreements. The Convention on Biological Diversity (Rio de Janeiro 1992) was drafted by international working groups, facilitated by UNEP, and signed by 157 countries at the United Nations Conference on Environment and Development (UNCED). The principal objectives of the Convention are the conservation of biological diversity, the sustainable use of its components, and the sharing of the benefits that come from the use of genetic resources. To achieve these objectives, the Convention requires the signatories to identify important areas of biological diversity, to

establish methods to conserve at the site of origin and elsewhere, to regulate access to genetic resources, and to transfer technology relevant to the conservation and sustainable use of biological diversity on mutually agreed terms. The country studies that were produced in preparation for the Convention have proved useful to documenting the status of biodiversity and the benefits and costs of conservation (UNEP 1992 a and b).

Existing international agreements already provide some mechanisms for identifying and protecting sites of global biodiversity significance, along with some funds for their support (see Box 2). These include the World Heritage Convention, which has named eleven natural sites in the developing countries of Asia as being of global significance; the Ramsar Convention, through which twenty-six regional wetland areas have been listed; and Unesco's Man and the Biosphere

Box 3. Wildlife Trade in Asia

Hunting and trapping for trade can endanger individual species. It is estimated that total trade in wildlife and wildlife products worldwide amounts to a minimum of \$5 billion annually, and that 25–33 percent of that trade is illegal (WRI 1988). The Convention on International Trade in Endangered Species—through a system of export, import and re-export permits—prohibits trade in listed endangered species and restricts trade in species at risk of becoming endangered (see Box 2). Although CITES is regarded by many as successful, major problems include the behavior of nonparticipating nations and lax enforcement. Only two Asian developing countries are signatories, although a further eleven have ratified the treaty (see Table 11).

Illegal trade is monitored for CITES by the Trade Records Analysis of Flora and Fauna in Commerce (TRAFFIC) network, affiliated with WWF-International and IUCN. According to TRAFFIC reports, Asia continues to be the leading consumer of four valuable restricted wildlife products: Ivory (though African elephant Ivory sales have recently been banned), tortoise shell, musk oil, and rhinoceros horn. For example, WRI (1988)—quoting various sources—reported that Japan consumes, for its jewelry and ornament industry, more tortoise shell from the hawksbill turtle than any other nation. Japan can continue its trade because it took a reservation on the hawksbill when it joined CITES and so is not bound by the prohibitions that apply to a species listed in Appendix 1 of CITES (imminently

endangered). Musk deer, native to Bhutan, India, and Nepal, also is a protected species; but musk oil is a valuable medicinal product in Asia, and in the first third of 1987 alone, nearly 55,000 were killed to supply the musk oil imported to Japan (WRI 1988). The Asian consumption of rhinoceros products, however, is perhaps the most serious problem of illegal trade in wildlife. Though rhino horn is the most valuable part, rhinos are killed for various products, and since only 1970, 84 percent of the world's rhinoceros population has disappeared. About 2,400 Asian rhinos and only about 55 of the Javan species are left. Rhino horn is used in traditional Asian pharmacology throughout China, Korea, Taiwan, and elsewhere in East Asia. Substitutes are apparently available but they have not found broad acceptance.

Sustainable and regulated trade in wildlife products has the potential to yield significant economic benefits to developing countries. But the current pattern and scale of illegal trade in wildlife products seems likely to drive some species to extinction. Both rich and poor Asian countries have played a disproportionately large role in this trade. Greater support for and compliance with CITES by all Asian nations would make an important contribution to biodiversity conservation.

Source: WRI 1988.

(MAB) Program, which has recognized twenty-five biosphere reserves in the region. Appendix B shows the location of protected sites listed under each agreement. Other international agreements include the 1973 Convention on International Trade in Endangered Species (CITES), which covers wildlife trade in Asia (see Box 3), and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn 1979). These can provide useful frameworks for cooperation in protected area management or the conservation of threatened species.

The following chapter outlines the state of biodiversity in the Asia-Pacific region and the factors that threaten biodiversity over the next decade. Chapter 3 concentrates on the urgent need to establish and maintain nationally designated protected areas, and reviews some of the

constraints needing to be addressed. However, as protected areas represent only 3.8 percent of the land area in the Asia-Pacific region, maintenance of biological diversity on the 96 percent of land outside protected areas is also essential. This theme is developed in Chapter 4. Chapters 5 and 6 focus on the role the World Bank can play in supporting biodiversity conservation efforts in region, including the promotion and implementation of a regional strategy.

Note

1. See also, Ehrlich and Ehrlich 1981; Johnson and Alcorn 1989; Ledec and Goodland 1988; McNeely and Miller 1984; McNeely and others 1990; Morowitz 1991; Norton 1987; OTA 1987; Reid and Miller 1989; and Wilson 1988 and 1992.

Biodiversity Status and Trends in the Asia-Pacific Region



The Asia-Pacific region is marked by great geographic and biological diversity. It includes the world's highest mountain system, the second largest rainforest complex, more than half of the world's coral reefs, as well as tens of thousands of islands. The region encompasses segments of three of the world's eight biogeographic divisions¹ the Palaearctic, Indo-Malayan, and Oceanian realms, as well as the Indian and the Pacific oceans (see Map 1). These characteristics taken together—the biogeographic range, geographic isolation, climate and altitude variation, and large number of diverse and isolated islands—account for Asia's tremendous species richness (the number of species in an area) and high levels of endemism (the occurrence of a species in a certain locality or region only).

Species Diversity and Endemism

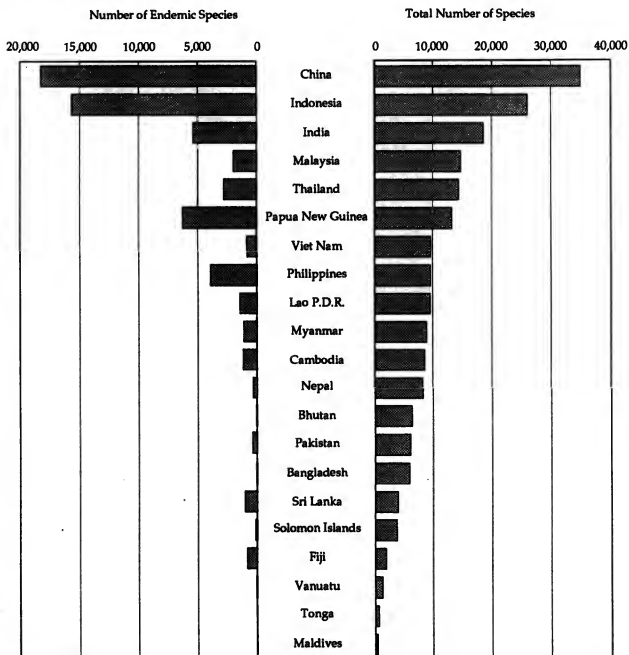
Estimates of the number of species and endemic species for Asian and South Pacific countries are shown in Figure 1. China and Indonesia are the most biologically diverse. Along with India and Malaysia, they are among the twelve so-called "megadiversity" countries which together account for 60 percent of the world's species (Mittermeier and Werner 1990).² China spans the Palaearctic and Indo-Malayan realms, and has over 10 percent of the world's flowering plants and about 10 percent of its mammals, birds, reptiles and amphibians. Indonesia, with several thousand islands scattered across the Indo-Malayan and Oceanian realms, has more species of plants and birds than the entire African continent, the highest number of mammals and swallowtail butterflies in the world, and is among the top ten countries in the world for numbers of flowering plants, birds, reptiles and amphibians (BAPPENAS, Indonesia, 1992). The greatest num-

ber of endemic species in the region are also found in China and Indonesia, with India, Papua New Guinea, and the Philippines also having large numbers.

An analysis of species and endemism according to biogeographic provinces and sub-units produces a somewhat different picture of biodiversity in Asia, one that is less biased in favor of large countries. Thus, in the Indo-Malayan realm, the greatest biological richness is found in the tropical rainforests of Indochina (Viet Nam, Lao P.D.R., and Cambodia), south China, Indonesia, Malaysia, Papua New Guinea, and the Philippines. Key areas for endemism include Borneo (Kalimantan, Sarawak, and Sabah), the Philippines, Sulawesi (for mammals), and parts of Indochina (MacKinnon and MacKinnon 1986; National Academy of Sciences 1980). In South Asia, the richest areas in terms of numbers of species and endemism are in India (the Western Ghats, as well as Assam and other northeastern states), the eastern Himalayas (including eastern Nepal and Bhutan), and the lowland moist forests of southwestern Sri Lanka.

In the Oceanian realm, there is a gradient of diminishing diversity from west to east. In the west, 75 percent of the 200 mammal species and 90 percent of the 11,000 plant species in Irian Jaya and Papua New Guinea are endemic. The smaller island nations to the east have fewer absolute numbers of species but have high levels of endemism, either per unit area or in proportion to their total numbers of species (Dahl 1986). The islands of highest conservation importance are: Viti Levi (Fiji); Rennell (the Solomon Islands); New Britain, Goodenough, and Bougainville (Papua New Guinea); New Caledonia, and Lord Howe Island.

The waters of the central and western Pacific and the Indian oceans together have the world's highest diversity of fish and shellfish, several

Figure 1. Estimated Numbers of Endemic Species and Total Species for Asian and South Pacific Countries

Source: WCMC 1992

times higher than that of the Eastern and Western Atlantic and the Eastern Pacific. Coral reefs, considered the marine equivalents of tropical rainforests because they support such diversity, are extensive, with eastern Indonesia (the Moluccas and Irian Jaya) accounting for the greatest biodiversity. The region's, and possibly the

world's, most pristine reefs are found in the Central Pacific, particularly off the Solomon Islands and Vanuatu, while the marine resources of the Maldives and Papua New Guinea are also exceptional. Despite the importance of marine resources, marine conservation in the region, as in the rest of the world, is still in its infancy.

Diminishing Natural Ecosystems

Asia's biological wealth is fast diminishing (see Map 2). Overall habitat losses have been most acute in the Indian subcontinent and China. The major ecosystems in the Indo-Malayan realm are estimated to have lost almost 70 percent of their original vegetation. Dry and moist forest have suffered 73 percent and 60 percent loss, respectively, while wetlands, marsh and mangrove have lost 55 percent of their original coverage (see Table 1). Bangladesh, India, southwest Sri Lanka, Viet Nam, coastal Myanmar, south and central Pakistan, Thailand, the island of Java in Indonesia, and the central islands of the Philippines have experienced extensive conversion of their natural habitats. Coral reefs cover an area of 450,000 square kilometers, of which 30 percent are considered degraded.

Although serious disturbances have taken place on some islands, biological destruction has been less severe, on the whole, in the Oceanian realm. Nevertheless, lowland rainforests have been destroyed in Western Samoa and Tonga, and are threatened in Fiji, the Solomon Islands, and parts of Papua New Guinea. Moreover, the rate of species loss in the Pacific is among the highest in the world, exacerbated by the high proportion of endemics in the area and the small population sizes. Only on the island of New Guinea are there large expanses of relatively undisturbed habitat, including wetlands, which apparently face little immediate threat.

Forests. Deforestation is a serious problem in most of the region. Nearly all of Southeast Asia was forested a century ago, but now it is esti-

mated that only about one-third is still under forest cover. Bhutan, Indonesia, Malaysia, Papua New Guinea, and the Solomon Islands have retained large portions of their natural forest, but many of these areas are now threatened with logging and agricultural encroachment. In addition, excessive poaching, hunting, and nontimber forest product collection, as well as introduction of exotic species and increasing pollution, all pose major threats to specific species and habitats in the region (Raven 1988).

Much of this deforestation is recent. For example, the proportion of forested land decreased from 44 percent to less than 25 percent in Sri Lanka between 1963 and 1981 (FAO 1986), and from 50 percent to 21 percent in Yunnan Province of China between 1949 and 1988 (China Conservation Strategy, 1990). Thailand's forest cover decreased from 53 percent of the country's total area in 1961 to 28 percent in 1988 and, by some estimates, will decrease to 20 percent in the early 1990s (FAO 1981a and TDRI 1987). Sixty percent of Indonesia's land (about 1 million square kilometers) remains under natural forest, but 10,000 square kilometers per year are lost through a combination of logging, forest fires, and shifting cultivation (World Bank 1990a). About 90 percent of lowland forests in the Philippines have disappeared in the past thirty years, causing massive losses in biodiversity, and only 5 percent of the land area remains under mature natural forest (World Bank 1989a).

This high rate of deforestation has changed hydrological regimes in the hills and caused erosion which, in combination with the loss of mangroves and destructive fishing practices, has led to degradation of coral reefs and the depletion of coastal fisheries. In Viet Nam, forest cover was halved during the war years, with 20,000 square kilometers of forests lost to chemical defoliants alone. Uncontrolled logging, high population growth in forested areas, and slash-and-burn agriculture have also contributed to accelerating deforestation. Remote sensing data indicate that about 20,000 square kilometers of primary forest remain, with current losses estimated at 2,500 square kilometers a year (Collins, Sayer, and Whitmore 1991). Lao P.D.R. retains large tracts of relatively undisturbed forest cover (roughly 30–35 percent), but these forests are under increasing pressure from commercial exploitation and, in some locations, a growing population (Lao Forest Inventory and Management Office 1991).

Table 1. Major Ecosystems in the Indo-Malayan Realm

Ecosystem	Original Area (km ²)	Remaining Area (km ²)	Percentage Lost
Dry Forest	3,414,064	940,145	72.5
Moist Forest	3,645,827	1,462,698	59.9
Grassland	106,250	40,025	62.3
Scrub/Desert	816,102	118,610	85.5
Wetland/Marsh	463,596	210,474	54.6
Mangrove	98,628	44,181	55.2
TOTAL	8,544,467	2,816,133	67.1

Source: WRI 1990.

The region-wide forestry statistics from FAO's global inventory compilation (FAO 1981b and 1988) provide a useful starting point for assessing the state of Asia's forests, even though the data are known to be somewhat inaccurate (FAO expects to publish a more reliable worldwide inventory in 1992). In 1988, FAO reported extremely high deforestation rates (defined as more than 1.5 percent annually) in China, Nepal, Sri Lanka, Thailand, and Vanuatu (see Table 2). Subsequent data published by WRI in 1990 suggest that rates of deforestation are higher than previously thought in several countries and that India, Myanmar, the Philippines, and Viet Nam are also losing their forests at more than 1.5 percent a year. Furthermore, biodiversity losses in forest areas are likely to be greater than these figures suggest, because deforestation data do not usually include cases where forests are degraded but not cleared and do not indicate the degree to which forests are fragmented into relatively small areas. Both

of these factors can contribute to increased loss of biodiversity.

Tropical forests vary in their biodiversity significance, and national deforestation statistics can provide only general guidance to the most important areas for conservation. Myers (1988 and 1990) has identified areas of the world where the disappearance of already-threatened moist tropical forests would cause the greatest losses of biodiversity (see Map 3). In Asia, these "hot-spots" include the remaining forests in the Philippines, peninsular Malaysia, northwestern Borneo (Brunei, Sabah, and Sarawak), the eastern Himalayas (Nepal, Bhutan, northeast India, and part of Yunnan Province in China), the Western Ghats in India, and southwestern Sri Lanka. In Oceania, "hot-spots" include New Caledonia.

Grasslands. Overgrazing by livestock and conversion to cropland are the principal threats to Asia's natural grassland ecosystems. Between

Table 2. Forest Cover in the Asia-Pacific Region

Country	Land Under Natural Forest (thousands of square kilometers)	Percentage of Total Land Area in Forest	Annual Deforestation Rate (percent)
Solomon Islands	24.4	90	..
Papua New Guinea	381.8	82	0.1
Cambodia	126.5	70	0.2
Malaysia	210.0	64	1.2
Indonesia	1,169.0	61	0.5-0.8
Lao P.D.R.	136.3	58	1.0
Korea, Republic of	48.0	48	..
Myanmar	319.4	47	0.3-2.1
Western Samoa	1.4	47	—
Bhutan	21.4	46	0.1
Fiji	8.1	45	0.1
Philippines	95.1	32	1.0-1.5
Viet Nam	101.1	31	0.6-2.0
Thailand	156.8	31	2.4-2.5
Sri Lanka	16.6	25	3.5
Vanuatu	2.4	20	1.7
India	572.3	17	0.3-4.1
Nepal	21.2	15	4.0
China	1,150.6	12	3.9
Tonga	<1.0	6	—
Bangladesh	9.3	6	0.9
Pakistan	24.8	3	0.4
Maldives
Kiribati

.. Negligible.

— Data not available.

Source: FAO 1988 for all figures, except the higher annual deforestation rates for Indonesia, Myanmar, Philippines, Viet Nam, Thailand, and India, which are from WRI 1990.

1970 and 1985, the total area of permanent cropland increased by 3.3 percent, whereas permanent pasture decreased by 2.8 percent. Large areas of China's grasslands have already been converted to agriculture and an estimated 30 percent of those that remain are degraded (Chinese Academy of Sciences 1990). On the Tibetan Plateau, traditional patterns of human migration between the uplands and lowlands have been disrupted, leading to overgrazing and serious degradation of grasslands. Virtually all grasslands on the Indian subcontinent are described as overgrazed (WRI 1988).

Many pristine grassland habitats have been replaced by low-intensity agricultural ecosystems which are of considerable value, especially to birds and small mammals; these too are threatened by intensification and require considered management to maintain their character and worth (ICBP 1991).

Wetlands. Mangroves, marshes and inland bodies of fresh, brackish, and salt water support large numbers of aquatic and terrestrial organisms as well as waterfowl and shorebirds. More than half of Asia's wetlands have been lost and more than half of the mangroves in the Indo-Malayan realm have been cleared, many for conversion to aquaculture ponds (Scott 1989, and Scott and Poole 1989). About 80 percent of the remaining wetlands are in seven countries: Bangladesh, China, India, Indonesia, Myanmar, Papua New Guinea, and Viet Nam (see Table 3). Of the wetland sites of international significance, more than half are reported to be under pressure, with those in Bangladesh, coastal China, Malaysia, the Philippines, and Sri Lanka the most threatened. At least 50 percent of all sites are moderately or severely threatened in Cambodia, Indonesia, Lao P.D.R., Myanmar, and Pakistan. Relatively untouched wetlands are found only in New Guinea, where less than 20 percent are considered at risk.

Marine Areas. The marine areas of the region are under significant threat from the effects of urbanization, industrialization, off-shore mining, agricultural growth (increased soil erosion and use of agricultural chemicals), overfishing and oil pollution. Sand and coral mining and destructive fishing practices (particularly overfishing, dynamiting, and poisoning) are threats in Southeast Asia as well as in the Pacific island nations, al-

Table 3. Wetlands in the Asia-Pacific Region

Country	Wetlands of International Importance (thousands of square kilometers)	Percentage of Sites under Moderate to High Threat
China	163.0	39
Papua New Guinea	101.0	15
Indonesia	87.8	57
Bangladesh	67.7	82
Viet Nam	58.1	26
Myanmar	54.9	56
India	54.7	45
Cambodia	36.5	67
Malaysia	31.2	86
Thailand	25.1	47
Philippines	14.1	69
Pakistan	8.6	50
Sri Lanka	2.7	68
Lao P.D.R.	2.2	67
Korea, Republic of	1.0	58
Nepal	0.4	36
Bhutan	0.1	40
Maldives	—	—
Pacific Islands	—	—

Note: The sites or areas given represent only those sites identified in *A Directory of Asian Wetlands* (Scott 1989) as being of international importance and urgently in need of study; not all of the wetlands in any given country or region are reflected. — Data not available.

Source: Scott and Poole 1989.

though the reefs of the Indian Ocean and Western Pacific are more degraded than those of the Central Pacific (IUCN 1988). More than half the coral reefs in the Philippines and Indonesia are in advanced states of destruction, and comparable studies would probably indicate similar, if not worse, conditions in Thailand and Malaysia (White 1988).

Notes

1. The biogeographic system referred to here is that of Udvardy (1975 and 1984), the classification system most widely used for conservation planning. MacKinnon and MacKinnon (1986), in their analysis of the Indo-Malayan Realm, used a slight modification of Udvardy's system and further divided the provinces or units into subunits.

2. The other eight "megadiversity" countries are Brazil, Colombia, Ecuador, Peru, Mexico, Zaire, Madagascar, and Australia.

Biodiversity Conservation in the Asia-Pacific Region



Establishment of a system of national parks, wildlife sanctuaries and other kinds of protected areas is the single most important tool available for biodiversity conservation (see Box 4). Many species and ecosystems would not have survived in their natural environments without them. Although new or modified approaches to biodiversity conservation are receiving increasing attention (see Chapter 4), no viable alternative to conserving genes, species, and ecosystems *in situ*—that is, in their natural state—has yet emerged. It is important to note, however, that no single site can ever meet all the objectives of conservation; to be most effective, protected areas must be planned and managed within the context of national, regional, and international networks.

Protected Areas in the Asia-Pacific Region

The developing countries of the Asia-Pacific region contain about 1,200 of the 6,940 protected areas of the world. These areas encompass some 774,000 square kilometers or 3.8 percent of the total land area of the region—a proportion similar to that under protection worldwide (see Appendix Table A.2). Protected areas in China, India, and Indonesia account for about 80 percent of the total protected land area in the region. However, many important habitats are either unrepresented or under-represented. In Sri Lanka, for example, even though about 12 percent of the land area has been protected, the most biologically valuable areas—the moist forests in the southwest—are inadequately covered. The Indian protected areas system, Asia's third largest, has major gaps—including Ladakh, the eastern Himalayas, northeast India and the islands of Andaman, Lakshadweep, and Nicobar. While some countries have protected area systems that

are large or are a high proportion of their total land area, many others have ill-defined systems or no protected areas at all. In others, systems remain incomplete, particularly in the Pacific island nations and Indochina. The coverage of wetlands and marine areas is extremely limited throughout the region.

Terrestrial Protected Areas. The countries with the highest percentage of land gazetted for protected areas are Bhutan (19.4 percent), Sri Lanka (11.9 percent), Thailand (10.7 percent), Indonesia (10.0 percent), and Nepal (8.0 percent). At the opposite extreme, Cambodia, Lao P.D.R., and the Maldives have no legally protected areas; and Papua New Guinea, six Pacific island nations, Bangladesh, and Myanmar have formally gazetted 1 percent or less of their total land area (see Table 4).

These protected areas vary significantly in terms of their value for biodiversity conservation. Some have been established primarily for recreation and tourism and have limited biodiversity value; others are either too small or too degraded to contribute effectively to conservation. An alarming number are "paper parks," areas that, despite their designation, receive little or no effective protection or management and derive no benefits from their special status. Frequently, boundaries are not marked and are unclear to local people, who may even be unaware that there is a protected area at all; infrastructure is nonexistent; staffing is insufficient; fauna and flora have not been surveyed; there is no conservation management plan; and human activities incompatible with conservation continue unchecked. In some cases, protected areas are subject to so much human activity that they have little left that is worth protecting. In the Philip-

Box 4. Functions and Benefits of a Protected Area System

A system of protected areas is the core of any program that seeks to maintain the diversity of ecosystems, species, and wild genetic resources, and to protect the world's great natural areas for their intrinsic, inspirational, and recreational values.

A protected area system provides safeguards for:

- natural and modified ecosystems that are essential for maintaining life-support systems, conserving wild species and areas of particularly high species diversity, and supporting scientific research;
- culturally important landscapes (including places that demonstrate harmonious relationships between people and nature), historic monuments, and other heritage sites in built-up areas;
- sustainable use of wild resources in modified ecosystems;
- traditional, sustainable uses of ecosystems in sacred places or traditional sites of harvesting by indigenous peoples; and
- recreational and educational uses of natural, modified, and cultivated ecosystems.

Protected areas can be especially important for development when they:

- conserve water and soil in zones that are highly erodible if the original vegetation is removed, notably the steep slopes of upper catchments and river banks;
- regulate and purify water flow, notably by protecting wetlands and forests;
- shield people from natural disasters, such as floods and storm surges, by protecting watershed forests, riverine wetlands, coral reefs, mangroves, and coastal wetlands;
- maintain natural vegetation on soils of inherently low productivity that would, if transformed, yield little of value to human communities;
- maintain wild genetic resources or species important in medicine;
- protect species and populations that are highly sensitive to human disturbance;
- provide habitat that is critical to harvested, migratory, or threatened species for breeding, feeding, or resting; and
- provide income and employment, notably from tourism.

Source: IUCN, UNEP, and WWF 1992.

pinus, for example, many of the protected areas are so seriously degraded that they make little or no significant contribution to the conservation of biological diversity. Illegal wildlife hunting, logging, and agricultural encroachment are prevalent throughout much of Asia's protected areas.

MacKinnon and MacKinnon (1986) analyzed protected area coverage by biogeographical province and found that virtually all units in the Indo-Malayan realm have at least one protected area, with the exception of parts of Myanmar and south China (Appendix B). But many habitat types are under-represented or absent, a notable example being the lowland dipterocarp forests of Malaysia. The protected areas systems in Bangladesh, Indochina, and the Philippines have poor coverage of habitat types. Coverage is strongest in parts of India and northeast Sri Lanka.

Although China's protected areas are not evenly distributed across the country (WCMC 1990), all biogeographic provinces are repre-

sented by at least one, and many of the provincial governments have identified additional areas they wish to protect. However, most of China's protected areas are located in the east, while the west and north—the temperate grasslands and deserts, and the high-altitude ecosystems of the Qinghai-Tibet Plateau—have few (Li and Zhao 1989).

Protected area habitat coverage is considerably less comprehensive in the Oceanian realm, although the threats are often less immediate. Only about 0.15 percent of total land area is included, representing less than 20 percent of ecosystem types. Three of the twenty biogeographical provinces have no protected areas, and only two are considered adequately represented (Dahl 1986).

Wetland and Marine Protected Areas. About half of the wetlands of international importance in the Asia-Pacific region, representing nearly 15 percent of the total wetland area, are included in protected area networks, although many coun-

Table 4. Protected Area Systems in the Asia-Pacific Region

Country	Area Protected (square kilometers)	Percentage of Land Protected
Kiribati	266	38.9
Bhutan	9,061	19.4
Sri Lanka	7,837	11.9
Thailand	55,140	10.7
Indonesia	192,309	10.0
Nepal	11,260	8.0
Korea, Republic of	7,568	7.7
Pakistan	36,550	4.5
Malaysia	137,701	4.5
India	14,880	4.3
Mongolia	61,678	3.9
China	8,975	2.9
Viet Nam	283,578	2.7
Philippines	5,729	1.9
Bangladesh	968	0.7
Fiji	53	0.3
Myanmar	1,733	0.3
Papua New Guinea	290	0.1
Western Samoa	0	<1.0
Solomon Islands	0	<1.0
Tonga	0	<1.0
Vanuatu	0	<1.0
Cambodia	0	0
Lao P.D.R.	0	0
Maldives	0	0

Note: Figures represent only those protected areas over 10 square kilometers and listed in IUCN categories I-V. Although Western Samoa, Solomon Islands, Tonga, and Vanuatu have no such protected areas over 10 square kilometers, they do have smaller areas as reflected in the percentage of land protected.

Source: WCMC 1992.

tries in South and East Asia are under-represented (see Table 5). Greater protection has generally been provided in South Asia, where Bhutan, Nepal, India, Sri Lanka, and Pakistan have a significant proportion of their wetlands under some form of protection. In Southeast Asia only Indonesia has a reasonable proportion of its wetlands protected. The Asian countries with the least wetland protection are Cambodia, Lao P.D.R., Mongolia, Myanmar, and Viet Nam (Scott and Poole 1989).

Protection of marine areas in the Asia-Pacific Region is variable; for example, although protection legislation or *de facto* protection is in place, island countries such as the Maldives and the Solomon Islands have no coastal or marine parks (see Appendix Table A.2). Some countries have proposed sites for new marine protected areas,

and Malaysia, the Philippines, Sri Lanka, and Thailand have initiated marine park programs. China and India have the greatest number of marine parks, but overall habitat coverage is poor. Virtually all reviews acknowledge a dearth of information about inland and coastal wetlands and marine areas. This information gap needs to be corrected as a matter of urgency, since these areas are facing increasing threat.

Site-Specific Priorities. Basic knowledge of conservation needs in the Asia-Pacific region is reasonably good. National-level analyses of biodiversity, which assess the existing protected area systems and identify additional areas needing protection, have been prepared or are under preparation for every Asian country except Cambodia and the Maldives; some coverage has also been afforded the South Pacific islands. For example, India's National Wildlife Action Plan (Rodgers and Panwar 1988) is a comprehensive review of conservation needs and priorities. The Integrated Protected Area System (IPAS) project in the Philippines is in the process of identifying priority protected areas (World Bank 1989a). A study of the status of biological diversity and the coverage of the conservation system in China is currently being carried out by WWF-International, although the large amount of information available has yet to be consolidated. FAO has assisted in carrying out national assessments in India (FAO 1988), Indonesia (UNDP/FAO 1981 and 1982), Myanmar (FAO 1985 a,b) and Thailand (FAO 1981 a,b). Other studies have addressed biodiversity conservation needs in environmental contexts; these include Tropical Forest Action Plans (with FAO assistance), Environmental Profiles (sponsored by USAID), and Environmental Action Plans (EAPs) (UNDP and World Bank). These assessments generally provide sufficient information for devising national conservation strategies and initiating efforts to strengthen biodiversity conservation systems. Information is seriously lacking only in Cambodia, the Maldives, and Papua New Guinea, though it is not easily accessible in China.

Many studies have attempted to identify the sites in the region that are most urgently in need of protection (see Box 5). Two updated lists will be published during 1992, one as part of the Convention of Biological Diversity, the other by IUCN's Plant Conservation Office (see Appendix B).

Table 5. Number and Area of Important Wetlands under Protection in the Asia-Pacific Region

Country	Number of Sites	Area of sites (square kilometers)	Area Under Some Form of Protection (square kilometers)	Percentage Area Under Some Form of Protection	Area Totally Protected (square kilometers)	Percentage Area Totally Protected
China	192	163,000	20,500	13	20,000	12
Papua New Guinea	33	101,000	6,000	6	6,000	6
Indonesia	137	87,800	30,300	35	29,000	33
Bangladesh	12	67,700	6,150	9	355	<1
Viet Nam	25	58,100	698	1	495	<1
Myanmar	18	54,900	248	<1	40	<1
India	93	54,700	16,200	30	15,300	28
Cambodia	4	36,500	20	<1	20	<1
Malaysia	37	31,200	16,600	53	64	<1
Thailand	42	25,100	1,910	8	410	2
Mongolia	30	15,500	50	<1	0	0
Philippines	63	14,100	942	7	761	5
Pakistan	48	8,580	5,210	61	1,380	16
Sri Lanka	41	2,740	825	30	766	28
Lao P.D.R.	4	2,220	0	0	0	0
Korea, Republic of	21	1,070	131	12	58	5
Nepal	17	356	275	77	261	73
Bhutan	5	85	65	77	5	6
TOTAL	822	724,650	106,125	14.7	74,915	10.3

Note: The sites or areas given represent only those sites identified in *A Directory of Asian Wetlands* (Scott 1989) as being of international importance and urgently in need of study.

Source: Scott and Poole 1989.

The World Bank has initiated a project with the marine section of IUCN's Commission on National Parks and Protected Areas (CNPPA) to identify and map all marine protected areas in the world. Background information on the biodiversity of each of these areas is being used to determine priorities for investment in conservation, especially in terms of strengthening existing areas and establishing new ones. Recommendations are being made for research where information is lacking. CNPPA has divided the marine realm into eighteen biogeographic regions, five of which cover Asia-Pacific countries. Table 6 presents priority marine protected areas in the jurisdiction of these countries as identified and mapped by the project (see also Appendix B).

In a new assessment of biodiversity, the International Council for Bird Preservation (ICBP 1992), has shown that remarkable concentrations of bird species with restricted ranges are confined to very small areas (see Appendix B). These centers of endemism additionally embrace three-quarters of all threatened bird species and are of great importance for other rare and threatened

species of animals and plants. In the Asia region, endemic bird areas that are of highest priority for conservation include the Eastern Himalayas, Luzon and Mindoro in the Philippines, and the Lesser Sunda Islands in Indonesia. Overall, these studies showed that Indonesia has more birds of restricted range, more threatened species (12 percent of world total), and more endemic bird areas (11 percent of world total) than any other nation.

These various studies should provide useful and important information to guide biodiversity planning at local, national, and regional levels, and could serve as a basis for site-specific conservation efforts. In spite of such efforts, it will sometimes be necessary to proceed without comprehensive information on a range of questions about economic value and ecosystem dynamics.

Ex-Situ Protection. *Ex-situ* protection plays a role by conserving a small but often critical part of total diversity (Ashton 1988; Hoyt 1988). India and Indonesia, for example, have important botanical collections and most countries in Asia

Box 5. Studies on Priority Biodiversity Conservation Sites

A number of studies that have attempted to identify the highest priority sites for biodiversity conservation in the Asia-Pacific region could serve as a basis for site-specific conservation efforts:

- **Corbett Action Plan (IUCN 1985).** The Corbett Action Plan provides a regional overview of actions needed for more effective planning and management of protected areas in the Indo-Malayan realm. It spells out general guidelines for action, as well as specific requirements for each country. Some forty-four areas are identified as fragile and threatened and in need of special protection.
- **Review of the Protected Areas System in the Indo-Malayan Realm (MacKinnon and MacKinnon 1986).** The Review identifies 173 protected areas of global importance in the realm and the best protected examples of each major biological community or sites of other special interest. The review also identifies major gaps in the protected areas system, noting that ten of the twenty-six biounits in the realm are inadequately covered in the current system. The study also identifies priorities for current strengthening of protection and species conservation (see Appendix B).
- **Review of Protected Areas System in Oceania (Dahl 1986).** A group of 226 Pacific islands that are known to have features such as endemic species or protected areas are ranked according to conservation interest, risks to that interest, and the conservation actions needed for each major type of ecosystem.
- **Action Strategy for Nature Conservation in the South Pacific Region (SPREP 1989).** The Action Strategy recognizes the need to establish a rep-

resentative system of conservation areas to ensure effective conservation of island ecosystems and species. This is to be achieved through the identification and conservation of the most unusual ecosystems and species; the identification of good indicator species for monitoring the condition of conservation access; and the evaluation of the management conditions and objectives of protected areas.

- **A Status Overview of Asian Wetlands (Scott and Poole 1989).** The Overview contains descriptions of a total of 947 wetland sites, including their legal protection, threats, effectiveness of conservation measures, and wetland types and sites in urgent need of protection (see Tables 3 and 5).
- **IUCN Directory of South Asian Protected Areas (IUCN 1990).** The Directory covers the protected areas systems of Bangladesh, India, Pakistan, and Sri Lanka. Summary data are presented for all protected areas known to exist in these countries but only 100 are described in detail.
- **Action Program for the Conservation of Wetlands in South and West Asia (IWRB and AWB 1992).** This Action Program is concerned primarily with activities required to conserve the natural functions and values of wetland ecosystems through sound management and sustainable use of resources, and to develop the tools by which this goal might be achieved (national policies and legislation, monitoring and research, exchange of information, training, education, public awareness, and international cooperation). High priority is given to development of comprehensive national strategies and action plans.

have zoos. Botanical gardens and zoological parks have international networks to help coordinate conservation efforts, such as maintaining databases on species kept in zoos, to facilitate breeding and species recovery efforts. The Consultative Group on International Agricultural Research (CGIAR) set up the International Board on Plant Genetic Resources (IBPGR) in 1974 to encourage and coordinate the development of a network of crop genebanks in developing countries. The International Rice Research Institute (IRRI) in the Philippines, the Central Rice Research Institute in India, and the Central Research Institute for Food Crops in Indonesia maintain major collections of

tropical rice. Germplasm facilities continue to expand worldwide, reflecting the increasing awareness and appreciation of maintaining plant genetic resources for modern agriculture and forestry. In July 1992, India's National Bureau of Plant Genetic Resources announced a seven-year, \$23.9 million project to build a bank for conserving over 800,000 seed samples.

Factors Affecting Protected Area Management

Legal Framework. Most Asian countries have basic conservation legislation related to wildlife

Table 6. Priority Areas for the Conservation of Marine Biodiversity

Marine Region	Country	Name
Southeast Asia	Indonesia	Bunaken Marine Park
	Indonesia	Sebagian Kep. Aru Bagain Tenggara Marine Park
	Indonesia	Telek Cenderawasih Marine National Park
	Indonesia	Kepulauan Karimun Jawa Marine Park
	Indonesia	Kepulauan Seribu Marine National Park
	Malaysia	Kuala Gula-Matang
	Malaysia	Kuala Selangor Mangroves
	Malaysia	Palau Tioman
	Malaysia	Tanjong Dungun, Rantau A.Bang, Merchang
	Malaysia	Palau Redang Marine Park/Palau Lang Tengah
	Malaysia	Palau Perhentian
	Malaysia	Palau Sempema
	Malaysia	Palau Sipadan
	Philippines	Tubbataha Reefs National Marine Park
	Thailand	Khao Laem Ya National Park
	Thailand	Mu Ko Surin National Park
	Thailand	Tarutao National Park
	Viet Nam	Cat Ba Islands and Halong Bay
	Viet Nam	Sinh Ton Atoll
	Viet Nam	Con Dao Islands
Northwest Pacific	China, Hong Kong	Delta of the Xijian River
	China	Hainan Island
	China	Bo Hai Bay
	China, Viet Nam, Philippines	Xi-Nan-Zhongsha
	Republic of Korea, Japan	Korean Strait

protection and the establishment of protected areas, although many of the laws are weak and aimed at conserving species rather than habitats. Legislation is most comprehensive in China, India and Sri Lanka, and new legislation is being drafted or enacted in Bhutan and the Philippines. However, conservation legislation is virtually nonexistent in Cambodia, Lao P.D.R., and the Maldives, which do not have protected area systems, and is weak in many of the Pacific island countries. An attempt to describe the comprehensiveness and enforcement of conservation legislation is shown in Table 7.

Institutional Capacity and Responsibility. By and large, the government agencies responsible for protected area management in the Asia-Pacific region have extremely limited operational capabilities and political influence. They frequently lack the authority necessary to perform their roles effectively, and staff morale tends to be low. Most agencies, including those in Bangladesh, Indonesia, Nepal, the Philippines, Sri Lanka, and Thailand are overcentralized, and many have hostile relationships with local governments or communities.

Responsibility for wildlife conservation in Asia usually lies with forestry ministries or departments (see Table 8), which have traditionally emphasized timber production and have given limited attention to conservation. In China, Malaysia, Sri Lanka, and many South Pacific countries, the responsibility for protected areas is divided among two or more national agencies. This complicates efforts to develop and implement national conservation plans.

In India and China, the main responsibility for conservation lies with state or provincial authorities, and while decentralized management in these large countries is appropriate, the commitment of institutions at the state level varies. In India, for example, although the national government strongly supports conservation, the commitment and level of activity in many states is poor or indifferent. In China, local governments also differ widely in terms of commitment, capacity, and financial resources for protected area management. In Malaysia, the division of responsibility between federal and state governments also poses difficulties for conservation initiatives. The state governments of Sabah and Sarawak are responsible for natural resource management,

Table 7. National Conservation Legislation and its Enforcement

Country	Comprehensiveness	Enforcement
Bangladesh	2	1
Bhutan	1	1
Cambodia	0	0
China	2-3	1
India	3	1-2
Indonesia	2	1
Korea, Republic of	1	1
Lao P.D.R.	0	0
Malaysia	2	2
Maldives	0	0
Myanmar	1	1
Nepal	2	1-2
Pakistan	3	1
Philippines	2	1
Sri Lanka	2-3	2
Thailand	2	1
Viet Nam	1	1
Papua New Guinea	1	1
Solomon Islands	1	1
Tonga	1	1
Vanuatu	1	1
Kiribati	1	1
Fiji	1	1
Western Samoa	1-2	1

0 = Virtually Nonexistent

1 = Weak

2 = Moderate

3 = Comprehensive

including agriculture, forestry, and water resource management. In all such cases, efforts must be made to strengthen institutions directly responsible for protected areas.

Financial Resources. The existing level of government expenditure is inadequate to assure the long-term survival of protected areas. A sampling of operating budgets for protected area management in Asia suggests that annual expenditures range from \$54,000 to \$364,000 per park (see Appendix Table A.3), or \$5 to \$794 per square kilometer. In total, although the estimates are difficult to verify, direct government expenditures for protected area management in the region appear to be about \$30 million-\$35 million annually (see Table 9), most of which involves outlays for acquisition of the lands to be protected; preparation of management plans; and capital expenditures for developing roads and facilities and for operation of the protected area, including staff salaries, administrative costs, maintenance, law enforcement, education, re-

search, and monitoring programs (Dixon and Sherman 1990). In addition, about \$65 million was committed by international sources in the late 1980s (see Table 10), of which an estimated \$10 million-\$15 million was expended annually. However, much of this has been used for research and other studies carried out by expatriates, and not for protected area management.

IUCN, among others, has attempted to define the level of expenditure that is required for adequate management of protected areas. It estimates that one park official, whose salary, housing, and subsistence averages \$5,000 per year, is required for every 50 square kilometers of park land. This estimate combined with other attempts to derive annual costs for park management suggests that a bare minimum of \$100 million per year is needed to support only the routine expenditures of protected areas in the Asia-Pacific region. To carry out necessary improvements in protected area planning and management—including providing adequate infrastructure, equipment, and supplies, to conduct resource surveys and monitoring, and to increase staffing levels would multiply this cost several-fold. Significantly increased funding is also needed for education, training, and other institution-building efforts in biodiversity conservation, as well as for public awareness campaigns at national, state, and local levels.

Given these figures, it is reasonable to estimate that at least a tenfold increase over existing levels of investment would be required to establish a protected area system sufficient for conserving biodiversity in the Asia-Pacific region. Appropriate levels of expenditure for each site would vary according to a variety of factors, for example, area size and management objectives, type and intensity of threats to plants and animals, fragility of key species and habitats, and tourism potential.

Human Resources. In general, the staff of most government conservation agencies in the Asia-Pacific region are inadequately trained, or are trained in production forestry or silviculture rather than conservation. This is true at all levels, from field staff to mid-level managers to top-level administrators, and presents a particular problem for countries beginning their protected area systems, such as Lao P.D.R., Papua New Guinea, Viet Nam, and the Pacific island nations. It is also a problem for Bhutan, China, Indonesia, Nepal, the Philippines, Sri Lanka, and Thailand, all countries with extensive protected area systems.

Table 8. Government Agencies Responsible for Biodiversity Conservation

Country	Agency	Country	Agency
Bangladesh	• Forest Directorate, Ministry of Environment and Forests	Nepal	• Department of Forests, Ministry of Forests and Environment
Bhutan	• Wildlife Division, Department of Forestry, Ministry of Agriculture	Philippines	• Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources
Cambodia	• Directorate of Forest and Hunting, Ministry of Agriculture	Sri Lanka	• Department of Wildlife Conservation, Ministry of Lands, Irrigation and Mahaweli Development
China	• Ministry of Forestry • National Environment Protection Agency • State Oceanographic Administration • Ministry of Agriculture • Ministry of Construction		• Forest Department • Coast Conservation Department, National Aquatic Resources and Research Agency • Central Environment Authority
India	• Department of Environment, Forests and Wildlife, Ministry of Environment and Forests	Thailand	• National Parks Division and Wildlife Conservation Division, Royal Forest Department • Office of the National Environment Board, Ministry of Science and Technology
Indonesia	• Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry • Ministry of Environment	Viet Nam	• Forest Protection Department, Ministry of Forests • Ministry of Agriculture • Ministry of Water Resources • State Committee for Sciences
Lao P.D.R.	• Wildlife and Fisheries Conservation Division, Department of Forestry and Environment, Ministry of Agriculture and Forestry	Fiji	• Department of Forests, Ministry of Forests • National Trust for Fiji • Environment Unit, Department of Town and Country Planning • Fisheries Department, Ministry of Primary Industries
Malaysia Federal and Peninsular	• Department of Wildlife and National Parks, Ministry of Science, Technology and Environment • Forestry Department • Federal Fisheries Department	Kiribati	• Ministry of Line and Phoenix Groups • Ministry of Environment and Natural Resources Development
Sabah	• Department of Wildlife, Ministry of Tourism, Environment, and Development • Forest Department	Papua New Guinea	• Department of Environment and Conservation, Ministry of Environment and Conservation
Sarawak	• National Parks and Wildlife Office • Forest Department	Solomon Islands	• Environment and Conservation Division, Ministry of Natural Resources
Maldives	• National Environment Council • Ministry of Planning and Environment	Tonga	• Parks and Reserves Authority, Ministry of Lands, Survey and Natural Resources
Myanmar	• Wildlife Conservation and Sanctuaries Division, Forest Department • National Commission for Environmental Affairs	Vanuatu	• Department of Agriculture and Forestry, Ministry of Agriculture and Fisheries and Forestry (MAFF) • Department of Fisheries, (MAFF) • Department of Physical Planning and Environment, Ministry of Home Affairs
Nepal	• Department of National Parks and Wildlife Conservation, Ministry of Forests and Environment • Department of Soil and Water Conservation, Ministry of Forests and Environment		

Table 9. National Conservation Budgets for Protected Areas

Country	Approximate Budget for Conservation (thousands of dollars)	Percentage of Total Annual National Budget	Per Capita GNP (dollars)
Bhutan	1,900	0.29	150
Thailand	15,100	0.19	1,000
Tonga	30	0.17	800
Myanmar	1,400	0.10	<500
Papua New Guinea	925	0.10	770
Western Samoa	20	0.09	580
Nepal	475	0.07	170
Indonesia	6,000	0.06	430
Malaysia	5,000	0.06	1,870
Viet Nam	225	0.05	<500
Sri Lanka	635	0.04	420
India	4,000	0.03	330
Bangladesh	645	0.01	170
Philippines	645	0.01	630

Data not available for China, Fiji, and Republic of Korea. Kiribati, Vanuatu, Solomon Islands, Maldives, Cambodia, and Lao P.D.R. have negligible budgets.

This limits a country's ability to plan and manage effective conservation programs, to carry out research, and to monitor its capacity to absorb additional funds.

In addition to the shortage of trained staff, most countries do not have enough trainers and educators for the planning and management of protected areas. They lack institutions, programs, and materials for training, as well as facilities to provide students with practical field experience. International donors have often responded to these constraints by sending local officials and their staff to foreign universities or training programs; but this has the disadvantages of being expensive, limiting the number of people to be trained, providing training that may be inapplicable to conditions in developing countries, and carrying the risk that trainees will not return to work in their respective countries.

There is a critical need to develop conservation training programs in Asia, including in-service training for field staff, graduate and postgraduate training for mid- and upper-level staff, and training of conservation educators. Training for lower-level staff should be developed through national and state training programs. Training for mid- and upper-level staff is best carried out

through graduate and nondegree programs at national or regional universities. The Wildlife Institute of India at Dehra Dun, Mahidol University in Bangkok, the School for Environmental Conservation and Management in Bogor, Indonesia, and the University of the Philippines at Los Baños, all offer graduate or postgraduate conservation training. However, since these facilities do not have the capacity to meet all the training needs of the region, additional facilities are required. In addition to training in the traditional conservation skills (for example, park planning and management, resource assessment, and wildlife management), field staff must also acquire the ability to work effectively with local communities. Training in areas such as the management of marine parks and wetlands also needs to be strengthened.

Role of Nongovernmental Organizations. It is no coincidence that national commitment to biodiversity conservation tends to be strongest in countries with strong NGOs that can play an advocacy role vis-a-vis governments. India, Nepal,

Table 10. Annual Funding of Biodiversity Conservation in the Asia-Pacific Region from International Sources

Funding Source	Total (millions of dollars)	Asia Region (millions of dollars)
U.S.-Based Efforts (bilateral, NGOs, foundations) (1989)	62.9	6.5
OECD countries other than U.S. (1989)	79.0 [†]	8.0 [†]
UNDP (1988)	9.4	3.0
World Bank (1988)	—	30.0
Asian Development Bank	—	—
FAO Conservation of Tropical Forest Ecosystems (1986)	41.4	13.7
International Tropical Timber Organization (1989)	0.2	0.1 [†]
Commonwealth Secretariat (average per year 1984-89)	0.1	0.1

[†] Estimate.

— Data not available.

Sources: Markandya 1990, for all data except those for U.S.-based efforts (derived from Abramovitz 1991) and for the World Bank.

the Philippines, Sri Lanka, and Thailand have relatively strong and active environmental movements, as do to a lesser extent, Indonesia and Malaysia. In addition, the presence of NGOs capable of implementing conservation initiatives at the local level can expand a country's absorptive capacity for international funds and increase the effectiveness with which these funds are used. Those directly involved in protected area management include the King Mahendra Trust for Nature Conservation in Nepal, the Haribon Foundation for the Conservation of Natural Resources in the Philippines, Wildlife Fund Thailand, numerous community organizations in India (which has by far the strongest network of grassroots organizations working effectively at the local level), and the local affiliates of the larger international conservation NGOs. For political reasons, however, some regional governments have discouraged, or even prohibited, the development of local NGOs.

Political Commitment. India and Sri Lanka, with long traditions of wildlife conservation, have the strongest conservation ethic and the most developed legal and institutional frameworks for conservation among Asian countries. This is reflected in a relatively high degree of social and political commitment to biodiversity conservation. Most of the other Asian governments have yet to institute policies or devise land management systems that will secure the conservation of protected areas in the future. Government commitment varies widely, and there appears to be little correlation between a country's ability and willingness to pay for conservation. Only Bhutan, one of the poorest countries in the region, has devoted more than 0.2 percent of total public sector expenditures to biodiversity conservation (Table 9), virtually all of which goes to protected area management. Most countries devote far less.

Other indicators of commitment include the degree to which recommendations are implemented to strengthen protected area systems; public statements indicating high level support for conservation; levels of conservation expenditures relative to national income; monitoring the effectiveness with which conservation funds are spent; and use of international organizations for conservation assistance. Membership in international conservation conventions is also an important indication of the attention given to

biodiversity by a country. However, with the exception of India, Nepal, Pakistan, Sri Lanka, and Viet Nam, Asian participation in international conventions has been limited. There are many reasons for reluctance to ratify international conventions, including a concern that a convention's provisions cannot be met; or as in the case of the Pacific island nations, for example, a concern that the benefits would not justify the investment. Table 11 summarizes the current participation of countries in the region in international biodiversity conventions and the number of conservation sites listed under the conventions.

Prospects for Improving Management of Protected Areas

Taking all these previous factors into consideration, it would seem that Bhutan, India, Nepal, and Sri Lanka have high commitment to improving their conservation systems, while Bangladesh, Cambodia, Maldives, Myanmar, Solomon Islands, and Western Samoa are lower. The remaining countries fall in between.

What, then, are the possibilities of improving the management of the national protected area systems in the Asia-Pacific region within the next ten years? Based on past and current performance of national governments in the region (their political and legislative commitment, levels of expenditures, institutional capabilities, human resources, relations with local people, and strength of environmental NGOs), the following rough topology of the probability of improving conservation systems can be made:

- Low probability over the short term because of low commitment or poor institutional structure: Bangladesh, Cambodia, Maldives, and Myanmar.
- Fair probability (but slowly) because of institutional weakness, political or social constraints, or low absorptive capacity: Bhutan, Lao P.D.R., Pacific island nations, Papua New Guinea, the Philippines, and Viet Nam.
- Fair probability of rapid improvement because constraints are being addressed: China, Indonesia, Nepal, Pakistan, and Thailand.
- Good probability of rapid improvement if financial resources available: India, Malaysia, and Sri Lanka.

Table 11. International Conventions and Number of Sites Listed under Them

Country	Ramsar	World Heritage	CITES	Bonn (MIGR)	MAB
Bangladesh	R(1)	R	R	—	—
Bhutan	—	—	—	—	—
Cambodia	—	—	S	—	—
China	R(6)	R(2)	R	—	(8)
India	R(6)	R(5)	R	R	—
Indonesia	R(1)	R(2)	R	—	(6)
Korea, Republic of	—	R	—	—	(1)
Lao P.D.R.	—	R	—	—	—
Malaysia	—	R	R	—	—
Maldives	—	R	—	—	—
Myanmar	—	—	—	—	—
Nepal	R(1)	R(2)	R	—	—
Pakistan	R(9)	R	R	R	(1)
Papua New Guinea	—	*	R	—	—
Philippines	—	R	R	S	(2)
Sri Lanka	R(1)	R(1)	R	R	(2)
Thailand	—	R(1)	R	—	(3)
Viet Nam	R(1)	R	S	—	—
Pacific Island Nations	—	—	**	—	—

R Ratified.

S Signatory.

— Neither signed nor ratified.

() Number of sites designated.

* Papua New Guinea is currently taking steps to join the World Heritage Convention.

** No international conventions have been signed or ratified by the six small Pacific island nations except CITES, which has been ratified by Vanuatu.

Source: WCMC 1992 and other sources.

Notes

1. For reviews and evaluations of different approaches to conserving biodiversity, see McNeely and others 1990, OTA 1987, Reid and Miller 1989, Soulé 1991, and Wilson 1992.

2. IUCN categories I–V and greater than 10 square kilometers in size (WCMC 1992). The categories are under revision and guidelines are expected to be approved by the IUCN Council in 1993.

4

Key Elements of Biodiversity Conservation



Effective biodiversity conservation can be achieved only through a combination of actions. Chapter 3 discussed the importance of establishing and effectively managing a network of protected areas and described the current situation in the Asia-Pacific region. This chapter focuses on three critical elements of any program to protect biodiversity: improving the policy environment; meeting local needs by integrating conservation and development; and finally, mobilizing the financial resources needed to support these initiatives.

Improving the Policy Environment

A wide range of national policies, laws and regulations can create "perverse" incentives that discourage conservation, even as other policies are intended to provide incentives to conserve. For example, the conversion of natural areas and loss of biodiversity has often been accelerated by economic policies that encourage production for export markets, promote population resettlement, or open up remote areas to road construction and logging. Policies aimed at increasing agriculture, forestry, fisheries, energy, and industrial production can have similar effects. Proposed policies in such sectors as energy, industry, and infrastructure development can induce impacts on biodiversity as well as those in natural resource sectors like forestry, agriculture, and fisheries. While appropriate policies provide the basis for national development and for meeting the economic needs of people, inappropriate policies can result in unsustainable and inefficient natural resource use, and contribute unnecessarily to the loss of biologically significant natural habitats and species. Policies related to land tenure, forestry, and agriculture are particularly critical in this respect.

Land Tenure Policies. Changing property rights and land use laws can have a significant impact on biological diversity. For example, in the past fifty years, most governments have nationalized forest lands and given forestry departments the legal responsibility for managing them, a task formerly carried out by local communities relying on customary law. This has often led to ecologically destructive and economically inefficient exploitation of vast tracts of forest land, both by forest departments and concessionaires and by local people. Timber concessionaires seldom have a long-term interest in conserving forests, and local people who no longer have legal rights to harvest timber or forest products have few incentives to protect trees and strong incentives to clear the land for agriculture.

Insecure land tenure also contributes to forest destruction. In the Philippines, Thailand, and Indonesia, the lack of tenurial security has acted as a disincentive to land improvements and encouraged expansion of agriculture onto upland watersheds and marginal lands (Poffenberger 1990). Programs in the Philippines and Thailand are providing land titles on the assumption that this will help slow the movement of people to new lands, but this can also create problems if titles are provided to smallholders only for forest lands that have been "improved." In Sabah, for example, any native of the state can obtain title to forest land by clearing and cultivating it. In the Philippines, claims to cleared land have been made by both smallholders and the owners of large livestock operations.

Such policies encourage destruction and conversion of the forests even on lands that are unsuited for agriculture. They are based on the mistaken notion that agricultural land is always more valuable than natural forest, a view that often assumes that biological diversity and the

ecological services generated from natural forests have little or no value. This view is increasingly challenged by economists (for example, Pearce 1987; Peters, Gentry, and Mendelsohn 1989; and Repetto and others 1989).

Forestry Policies. Most Southeast Asian and Pacific island countries regard their forest lands primarily as resources for timber production and agricultural expansion. Forestry policies reflect this, by placing low value on intact forests and providing few incentives for sustainable timber harvesting. However, by encouraging unsustainable timber harvests, governments sacrifice long-term economic and ecological benefits for short-term financial rewards. Even short-term benefits can be dissipated through inefficient harvesting or processing, or through loss of benefits to internationally owned timber companies (Repetto and Gillis 1988). As a result, the economic benefits accruing to the country from forest exploitation have often ended up as a minute fraction of the real economic value of the forest, even before taking biodiversity values into account.

Low rents and royalties contribute to the problem. Many Asian countries with large areas of natural forests have forest revenue collection systems that fail to capture reasonable rents for the public treasury. Indeed, despite a variety of fees, royalties, taxes and other charges, total forest revenues have fallen far short of their potential in most timber exporting countries. The Philippines, for example, lost both forest cover and potential revenue as a result of the financial incentives that were given to Philippine timber companies. These incentives contributed to a logging boom from the early 1960s until the mid-1980s and the near elimination of the country's natural forests. The pattern of low revenue collection and high windfall profits has been repeated in many other countries in the region. Repetto and Gillis (1988) indicate that only Sabah manages to collect a high percentage of potential revenue through aggressive taxation. Sound policies in the forestry sector are therefore critical to both economic development and biodiversity protection.

Agricultural Policies. Many national policies supporting agricultural development also represent direct or indirect threats to biodiversity. For example, the Indonesian government has long

and actively promoted clearing and agricultural settlement on land in the Outer Islands, much of which is forested. Between 1980 and 1986, the transmigration program moved more than two million people from Java and Bali to the Outer Islands, reduced logged-over primary forest areas by at least 3,000 square kilometers, and reduced secondary regrowth by an equal amount (World Bank 1990a). Thai government subsidies to tapioca farmers in the late 1970s and 1980s, to increase exports of cattle feed to Europe, contributed to the decline of Thailand's eastern forests (Snidvongs 1989). Targets for crop and livestock production have similarly encouraged the expansion of agriculture into previously forested areas that are in some cases unsuitable for agriculture.

Subsidies provided by governments for the conversion of forest lands to agriculture include: direct financial support for infrastructure development; provision of grants to settlers; low-interest loans and tax deductions to private agricultural investors; and manipulation of farm output and input prices. Subsidies for agricultural inputs such as pesticides and chemical fertilizers can also lead to overuse, with resulting loss of beneficial insect predators, fish, and other forms of wildlife.

Sustainable development of agricultural land was addressed in one of the UNCED agreements, Agenda 21 (UNCED 1992). According to Agenda 21, priority must be given to maintaining and improving the capacity of higher potential agricultural lands to support expanding populations. However, conserving and rehabilitating natural resources and biodiversity on lower potential lands is also required to maintain sustainable human/land ratios (see Box 6).

Policies in Other Sectors. Although forestry and agriculture provide the most obvious examples of how national policies can negatively affect biodiversity, examples can be cited in many other sectors as well. A drive to increase fish exports from Thailand, for example, has resulted in overfishing in the country. Forest degradation in central Myanmar can be attributed in part to economic decline and limitations on imports of petroleum products, which forces poor people to substitute fuelwood for kerosene. Infrastructure and hydropower development, while critical to economic growth, have also had an adverse impact on the terrestrial and aquatic habitats of many Asian countries.

Box 6. Integrating Conservation with Agricultural Policy and Planning

Agenda 21 recognizes that major adjustments are needed in agricultural, environmental, and macro-economic policy at both national and international levels to integrate biodiversity conservation into agricultural practice. To begin the processes needed, the following program areas have been identified:

- "Agricultural policy review, planning, and integrated programming, in light of the multifunctional aspect of agriculture, particularly with regard to food security and sustainable development;
- "Ensuring people's participation and promoting human resource development for sustainable agriculture;
- "Improving farm production and farming systems through diversification of farm and non-farm employment;
- "Land resource planning information and education for agriculture;

- "Land conservation and rehabilitation;
- "Water for sustainable food production and sustainable rural development;
- "Conservation and sustainable utilization of plant genetic resources for food and sustainable agriculture;
- "Conservation and sustainable utilization of animal genetic resources for sustainable agriculture;
- "Integrated pest management and control in agriculture;
- "Sustainable plant nutrition to increase food production;
- "Rural energy transition to enhance productivity; and
- "Evaluation of the effect on plants and animals of ultraviolet radiation caused by the depletion of the stratospheric ozone layer.

Source: UNCTD 1992.

Clearly, protected areas alone will not be sufficient, and governments are encouraged to examine a range of economic policies to ensure that their adverse impact on biodiversity is minimized and that any losses in future value are fully justified. Institutions supporting economic development can play a critical role in protecting biodiversity by focusing their analyses on the environmental impacts of important economic policies and by helping governments take these issues into account in their macro-economic planning and sectoral analyses (see Box 7).

Integrating Conservation and Development

Human Issues in Protected Area Management.

Over the past ten years, the realization has grown that communities occupying lands in and adjacent to protected areas, along with local or national industries, bear substantial opportunity costs as a result of lost access. The benefits foregone from forest-products collection and livestock grazing, for example, may be significant. The benefits that could have been gained from conversion of the protected area to an alternative use, such as agriculture, mining or hydroelectric power generation, may be of even greater value

(Dixon and Sherman 1990). These costs are likely to increase as human populations grow and open lands outside of protected areas are depleted or converted.

Damage caused by protected wildlife is another common cost to local populations. In Nepal, for example, establishment of the Royal Chitwan National Park caused the large-mammal population to increase dramatically; as a consequence, villagers living just outside the park have suffered injury and death from bears, tigers, and rhinos; losses of livestock to tigers and leopards; and crop destruction by rhinos (Mishra 1984). Damage to crops from wild animals, particularly pigs and elephants, is common throughout tropical Asia (Seidensticker 1990, and Santiapillai and Jackson 1990).

As people in the communities around protected areas tend to be poor, politically powerless, and lacking in government services, a large part of the costs of conserving biological diversity is being borne by those least able to pay. Furthermore, when local people perceive that the establishment of protected areas will restrict their ability to earn a living, they have no incentive—indeed, they have a disincentive—to cooperate with park authorities. This can lead to rapid exploitation of resources before parks are estab-

Box 7. Tools for Integrated Conservation and Development

National conservation strategies and environmental action plans have been developed for many of the countries of the region, and country reports on sustainable development have been prepared by virtually all countries in the region in the UNCED process. These reports provide a means for countries to integrate conservation and development through adoption of a comprehensive, cross-sectoral approach to conservation and resource management. By focussing on national planning and public-sector decisions concerning the use of biological resources, these strategies and action plans can address many policy issues faced by governments seeking to use their biological resources on a sustainable basis. In addition, they usually provide for participation of various sectors and interest groups in reaching national consensus about policies on the use of biological resources.

Consistent and integrated land use planning is another effective tool for biodiversity conservation. Few, if any, countries in Asia, however, have well-developed land use planning capabilities, although efforts are being made by some governments. For example, Sri Lanka and Indonesia have land use planning projects, through the Asian Development Bank, for land classification and planning based on land capability studies; and Sri Lanka and Thailand are developing and implementing National Coastal Resources Management Plans, with assistance from the United States Agency for International Development. These programs have one drawback, from the viewpoint of biodiversity conservation, however, in that many of their most important contributions will benefit areas that are not particularly diverse biologically.

Source: McNeely and others 1990.

lished, or careless exploitation of resources within existing protected areas. Overemphasis on rigorous law enforcement is unlikely to provide a long-term solution to this problem. Successful management of protected areas is more likely to depend on gaining the cooperation and support of local people. Unless local people gain economic benefits from the protected area or are compensated for their loss, there is little likelihood that effective long-term protected area con-

servation can be achieved (Wells, Brandon, and Hannah 1992).

Assessing biodiversity in relation to past and present land and resource use offers opportunities for maintaining and restoring biological diversity in threatened areas. Consequently, special efforts must be made to understand the history of human impacts on the distribution of species, habitats, and ecosystems, notably the different ways in which people value, use, manage, and affect biodiversity (Nelson and Serafin 1992).

Meeting Human Needs. Integrated Conservation and Development Projects are one recent attempt to link the conservation of biological diversity in protected areas with local social and economic development. Where combined with a strong emphasis on the participation of local people, they can help address the problems arising from adversarial people-and-park relations. Most ICDPs try to stabilize land use outside park boundaries and to increase local incomes, with the ultimate objective of reducing the pressure for further exploitation of natural resources within protected areas. In addition to their development and conservation components, many ICDPs emphasize conservation education. All of the projects are based on the premise that protected area management must reach beyond traditional conservation activities inside park and reserve boundaries to address the needs of local communities outside.

Reconciling the needs of conservation and those of local people will not be easy (West and Brechin 1990; Machlis 1992). So far, most efforts to involve local people in protected area management have been small in scale and have had intensive technical and financial input (usually from international NGOs), while efforts to advance working knowledge of incentives and to refine methods of economic analysis have been largely theoretical. Some promising initiatives do exist, however. For example, in a 70-square-kilometer area of rainforest in the "Bird's Head" region of Irian Jaya, an agreement has been reached between the local Hatam people and the Forest Directorate under which the local people participate in thirteen village-level management committees that make decisions about reserve boundaries, regulations, and future plans, with the purpose of maintaining a naturally regenerating rainforest. Hatam landholders, who are allowed to continue their traditional forest

activities, have agreed in writing to uphold reserve regulations and to act as a "guard force" for reporting illegal forest cutting and other infringements of regulations by outsiders. There have been no known infringements by the Hatam or others to date (Craven 1990). Other examples of integrated conservation and development projects are shown in Box 8.

Although these and other initiatives have promising components and have enlisted a measure of local support for their goals, two factors have constrained ICDPs from making substantial progress. First, most of the projects have taken a long time to prepare and are at a relatively early stage of implementation (most have been operational for less than five years). Second, many of the projects have operated on a very small scale in relation to the size of the local population that

has an impact on the targeted park or reserve, making replicability questionable.

In summary, the ICDP approach is innovative and experimental. Programs often involve organizations with little experience in development, so a period of learning and gradual expansion has been unavoidable. In some cases, design and implementation flaws have led to problems similar to those experienced by the earlier generation of integrated rural development projects (Wells, Brandon, and Hannah 1992).

Women and Biodiversity. Women in developing countries often do most of the work of gathering medicines and firewood, drawing water, and growing subsistence food for their families. Over generations, they also have often developed extensive knowledge of forest products and local plants. Because women typically make economic use of a much wider range of products than men, they have a greater interest in sustaining the diversity of biological resources. Furthermore, evidence suggests that women's traditional work may be even more sensitive to policy changes than their community in general. For instance, the introduction of new farm machinery or agricultural development plans that push women into marginal land or forests, or, on the other hand, the introduction of solar-powered stoves that may take pressure off the forests, show clear connections between policy and women's opportunity to affect biodiversity (Abramovitz and Nichols 1992).

Recognizing this linkage, the Asia-Pacific Regional Assembly on "Women and the Environment: Partners in Life" in Thailand (March 1991), called for strategies that promote women's participation in planning, implementation, evaluation, and benefit-sharing. It is essential in the future that women specifically be included in the making of policy that has biodiversity implications if sustainable development is to be achieved.

Using Productive Areas for Biodiversity Protection. Another approach to integrating conservation and development is to maximize the protection of biodiversity in areas intended for other economic purposes. From a biological point of view protected areas that become isolated "islands" amid agricultural land and human settlements, invariably result in a progressive erosion of genetic diversity. This is because human activ-

Box 8. Three Integrated Conservation-Development Projects in Asia

Annapurna Conservation Area (Nepal). The 2,600-square-kilometer, multiple use area was established in 1986 under the jurisdiction of the King Mahendra Trust for Nature Conservation to mitigate the impacts of tourism on the environment and to promote local development. The 1986-89 cost was \$450,000; \$2.4 million is available for expansion during 1990-94.

Dumoga-Bone National Park (Indonesia). The 3,000-square-kilometer park was established in 1982 to protect the forested upland watershed of rivers supplying two irrigation projects used by 8,000 farmers to grow paddy rice. Funding of the irrigation projects was provided by a \$60 million World Bank loan, about \$1 million of which was used to establish the park.

Khao Yai National Park (Thailand). The 2,200-square-kilometer park, an important tourist attraction, is seriously threatened by logging and hunting. Two Thai NGOs began a project in one of 150 villages on the park border in 1985 to promote conservation through development, later expanding into several other communities. The 1985-89 cost was \$500,000.

Source: Wells, Brandon, and Hannah 1992.

ity sets up barriers against the normal mixing and outbreeding of species populations in the protected area. However, multiple-use agriculture or improved management of watersheds and forests around protected areas, can offer opportunities for extending the range of biodiversity protection while achieving economic objectives (Pimentel and others 1992).

A number of countries (for example, India and Malaysia) have working plans to link multiple-use forests and plantations with core zones of protected areas to reduce the "island" effect. For example, it may be possible in some cases to reduce this effect by linking adjacent protected areas with wildlife corridors, permitting the movement of organisms between "ecological islands." Measures include maintenance of natural forest strips along streams, other water courses, and migratory routes, and preservation of selective old growth stands. Silvicultural techniques for enhancing biodiversity protection in managed forests include selective thinning to favor species characteristic of natural forests, staggered harvesting to suppress weed growth and favor maintenance of habitat diversity, and controlling the size of the management unit and rotational interval of harvesting.

The extractive reserves concept is also generating increased interest as a possible approach to conserving biodiversity *in-situ* in combination with economically viable, yet ecologically sustainable, levels of resource extraction (Fernside 1989, Allegretti 1990, and Browder 1992). This is particularly attractive in buffer zones outside protected areas. The concept has so far been tested primarily in the Amazon rainforest, where the Government of Brazil has established the legal foundation for setting up extractive forest reserves that would be open only to traditional rubber tappers, whose livelihood has been threatened by timber harvesting and conversion of forests to cattle pasture. The Canadian International Development Agency (CIDA) is providing \$8.5 million in assistance to a project to develop the first such reserve in the Acre River Valley in western Brazil.

Extractive reserves in Asia could potentially be based on nontimber forest products such as rattan, which already have large commercial value. The export trade of finished rattan products from Asia, mainly from Indonesia and Malaysia, amounts to \$2.7 billion annually. Exports of other nontimber forest products (including oils, gums, spices, bamboo, medicinal, and animal products)

amount to over \$22 million. To judge from the Brazilian experience, setting up viable extractive reserves will involve a great deal of ecological, social, and economic research, complicated land and resource rights agreements, development of transportation and marketing mechanisms, provision of infrastructure, development of local production and marketing organizations, as well as effective regulation and management. In Asia, the potential for extractive reserves is probably greatest in the countries with more developed infrastructure and international marketing mechanisms, such as India, Indonesia, Malaysia, and Thailand. Since their primary function is production—albeit on a limited and sustainable basis—and not conservation, extractive reserves should be used as complements to rather than substitutes for protected areas (Browder 1990).

Mobilizing Financial Resources for Biodiversity Protection

Domestic Resource Mobilization. Although international resource transfers will be important in promoting biodiversity protection, most countries will have to rely on internal resource mobilization for at least a part of their conservation expenditures. In the case of countries with large forest estates or protected systems (such as Indonesia and Papua New Guinea), these expenditures may be considerable. In such cases natural resource taxes or levies on development or private sector use can provide promising avenues for generating financial support.

Taxes and Levies. Natural resource levies are already used by most countries to capture excess rents or profits from timber extraction and to channel them to other uses. In Indonesia, for example, the government has a surcharge of \$4 per cubic meter of timber that is used to subsidize the development of timber plantations. A surcharge of this type could also be used to finance biodiversity protection in part, or to compensate local governments for revenues foregone when forest resources are set aside for biodiversity and watershed protection. Through such levies and resource transfers, the incentives for extraction and protection can be gradually brought into balance. Papua New Guinea has discussed an even broader natural resource levy in which all natural resource extraction would be taxed and a fund established to promote environmentally and socially sound natural resource management by

local clans. Support for the development of such a fund and the design of mechanisms to make it work is under consideration by the GEF.

Development Linkages. Development projects frequently modify natural environments and may be opposed by concerned environmental groups; but such projects can also be used to obtain leverage and financial resources for biodiversity protection. In Sabah, Malaysia, for example, World Bank support for an oil palm development on the Dent Peninsula was used as an opportunity to upgrade adjacent protected areas and to significantly improve their protection and management, as well as strengthen the wildlife department and develop a state conservation strategy. Coal mining and oil companies in Indonesia have expressed interest in providing resources to protected areas, such as Kutai National Park in Kalimantan, but a major obstacle is the absence of a mechanism for government agencies to accept such resources and integrate them into the budget for the purposes intended.

Large multinational and national companies can often contribute managerial know-how as well as financial resources for biodiversity conservation, and international organizations with high visibility may be among the most willing to offer this support. Scott Paper, for example, proposed to assist conservation in Irian Jaya while developing timber plantations for pulp and paper. Under public pressure, Scott withdrew from this arrangement and local companies are now proceeding with pulpwood development without conservation investment.

Large dams, which may have adverse environmental consequences, can also be tapped to provide a sustainable revenue stream for conservation, particularly of surrounding watersheds. Such opportunities require serious consideration. For example, the Kaeng Krung dam in southern Thailand has strong NGO opposition as it affects a relatively pristine forest. The Electricity Generating Authority of Thailand (EGAT) favors the site because land is virtually free and hydropower is a renewable energy source where costs are not subject to oil price fluctuation. If this pristine land were assigned a scarcity value and costed appropriately, and if the revenue stream from power generation were tapped for conservation, resources could be mobilized to protect all remaining forested watersheds in southern Thailand. Without such resources and the improved management and awareness they could bring,

gradual degradation of these watersheds appears inevitable. An intensified dialogue between developers and conservationists would be helpful in clarifying options for all parties.

User Charges. Nature tourism has only begun to be developed by a few countries in Asia, and careful planning, as well as additional financing, will be required to build up the capacity to tap its potential (see Box 9). Only relatively small numbers of parks and reserves in developing countries attract the very large numbers of foreign tourists that are needed to generate substantial foreign exchange earnings and make significant contributions to national economic development. In Asia, the leading examples include Royal Chitwan National Park and the Himalayan parks of Nepal and Khao Yai National Park in Thailand. Most protected areas have limited tourism potential due to lack of infrastructure, difficulty of access, political instability, ineffective marketing, or simply the absence of spectacular or readily visible natural features.

The investments required to develop nature tourism will depend on the place, type of experience offered, and tourists targeted. At most sites the development of basic infrastructure, facilities for visitors, interpretive programs, and systems for collecting entrance fees in the parks will have to be set up, and mechanisms to evaluate the environmental and socioeconomic impacts of tourism should also be established. Infrastructure outside of protected areas, such as transportation and communication links, are also important. Additional financing will be required to build up Asia's capacity for nature tourism. Boo (1990) and Whelan (1991) are useful sources of further information.

Similarly, genetic resources, including medicinal plants, varieties of crops and livestock, and their wild relatives that may be valuable because of the genes they contain, could make significant contributions to local and national economies (see Box 10). At present, the benefits from these resources go almost exclusively to private, often multinational, companies (Reid 1991), but they could be a valuable source of financing for biodiversity conservation.

International Transfers. Debt-for-nature swaps and endowments or trust funds represent innovative means for funding biodiversity conservation activities, though they are likely to be of limited applicability in Asia.

Box 9. Nature-Based Tourism

Nature tourism or ecotourism has long been recognized as a potentially significant source of revenues for conservation. Such tourism can generate support for conservation in several ways: (a) by providing financial return, it can justify setting aside large areas of land for conservation; (b) park entry fees can generate substantial funds to support park and reserve management; and (c) tourist expenditures in and around parks (on lodging, transportation, food, guides, and souvenirs) can be an important source of income for communities near protected areas, compensating them for the loss of access to traditional resources and giving them an incentive to conserve the protected areas. For example, the Nepalese government has passed special legislation permitting entry fees collected for the Annapurna Conservation Area to be used for local conservation and to benefit local communities.

Dixon and Sherman (1990) have quantified the economic benefits of tourism in some of Thailand's protected areas. In all cases tourists' total expenditures were substantial and far exceeded the Government's direct management expenditures. Tourist spending at Khao Yai National Park amounted to between 100 million and 200 million baht (\$3.8 million-\$7.7 million) per year during 1982-88. The government's annual management costs for the park totalled 3 million to 4 million baht

(\$100,000-\$150,000), with a supplement for construction and other capital expenditures that ranged from 171,000 baht (\$7,000) in 1984 to 1.6 million baht (\$62,000) in 1986-87. Total tourist expenditures exceeded management costs by 200 to 600 percent at Khao Soi Dao Wildlife Sanctuary and by 300 percent at Thale Noi Nonhunting Area. These apparently clear demonstrations of economic benefits from some of Thailand's protected areas have not yet persuaded the government to establish adequate management to ensure protection and continuity.

Although ecotourism has many financial benefits it also generates problems. For example, unless managed carefully increased tourist visitation can degrade protected areas. Sagarmatha (Mount Everest) National Park in Nepal attracts tens of thousands of visitors each year for trekking and climbing, leading to serious garbage accumulation, waste disposal and excessive firewood collection. In Nepal, as elsewhere, the development of nature tourism has been based on private sector initiatives with little government regulation to protect the biological resources that draw visitors. The Action Strategy for Nature Conservation in the South Pacific Region (SPRSP 1989) has proposed that governments charge a special levy on the tourist industry to provide low interest loans for small-scale low impact tourism programs.

Debt-for-nature swaps. A debt-for-nature swap is a financial mechanism that can leverage conservation funds for many highly indebted developing countries. A swap involves the purchase of developing country debt at a discount by conservation organizations, and its redemption in local currency and use for conservation activities. The first debt-for-nature swap took place in 1987 in Bolivia. Since then there have been sixteen swaps in eight countries, mostly in Latin America, totalling about \$100 million.

Due to relatively good financial management in most Asian countries and the absence of discounted debt, the only swap made in Asia to date has been in the Philippines. In this case, the World Wildlife Fund-U.S. agreed to acquire \$2 million in Philippine debt, with the proceeds to be credited to a local currency account managed by the Haribon Foundation, a Philippine conservation NGO. The funds are to be used for planning and managing two parks on the island of Palawan, for helping the government enforce laws on illegal

trading and exploitation of wildlife, for carrying out plant surveys, and for helping finalize a plan for an integrated system of protected areas.

The World Bank cannot become directly involved in debt-for-nature swaps because legal limitations prevent it from eliminating Bank-owned debt in this way (Hansen 1988), but it can provide complementary financial support to countries directly involved in such swaps.

Trust funds and endowments. The distinction between endowments and trust funds is that an endowment may be given as a grant without terms stipulating how it is to be used, whereas a trust fund has clear terms and is held for the beneficiary by a trustee who has a legal responsibility to adhere to those terms. Trust funds and endowments have several advantages as means of funding biodiversity conservation activities (Wells 1991). The major advantage is that they provide a guaranteed, long-term flow of financial resources for conservation. An assured flow of

Box 10. Genetic Property Rights

Many plants and animals contain valuable genes. These genetic resources differ from biological resources because their value lies in the information contained in their genes, not in their physical attributes. Thus, a rice seed is a biological resource if eaten but a genetic resource if used as a source of a disease-resistant gene for breeding (Reid and Miller 1989).

The considerable uncertainty over the potential value of genetic resources has been compounded by the emergence of new biotechnologies, and controversy surrounds genetic resource ownership and access. At the root of current debates is the knowledge that the genetic resources found in many developing countries are assets that, if managed properly, could make significant contributions to local and national economies. But both governments and NGOs have argued that under current systems of ownership and access to these resources neither the countries possessing the resources nor

the individuals who are the custodians will receive equitable benefits from their use (Reid and Miller 1989).

As an example of the potential economic value of genetic resources to developing countries, Costa Rica has signed an agreement with a multinational pharmaceutical company under which a newly established Costa Rican institute, INBio, will collect plant species and carry out preliminary screening for their potential pharmaceutical use. As a part of this contract, Costa Rica will receive a 5 percent share of the revenues of any commercial product that might eventually result—a potentially enormous sum. The importance of deriving value from and adequately protecting genetic, as compared to biological, resources is still a relatively new area. It could, however, represent an innovative and valuable source of financing for biodiversity conservation.

funds would help cover the costs of operating and managing protected areas on a long-term basis. With a guaranteed source of income, conservation agencies also could increase their operating capacity through training and increased staffing.

Given the amount of capital needed and the relatively small annual flows, trust funds and endowments are likely to be most appropriate in poor countries with government commitment but low absorptive capacities and limited budgets. For example, a trust fund has been established in Bhutan with GEF resources of \$10 million that will be used to leverage an equivalent contribution from other donors. The Royal Government of Bhutan (RGOB) will also contribute funds equivalent to 10 percent of the trust fund's disbursements each year, over and above the RGOB's current level of funding for environmental programs. The interest generated from the principal will be spent on developing human resources and institutional capacity to carry out and manage conservation programs, as well as to

conduct surveys and develop an ecological information base in Bhutan.

The U.S. Agency for International Development (USAID) has helped establish a trust fund in Sri Lanka to support and facilitate education, technical assistance, fund-raising, and innovative public-private approaches to sustaining wildlife in Sri Lanka. The \$500,000 start-up funding provided by USAID will be used to leverage additional resources through profit-generating investments in conservation.

Given the scale of the resources needed to protect biodiversity in the region, endowments or trust funds cannot be expected to be major vehicles for conservation funding. But there are several countries in addition to Bhutan whose access to local resources and foreign exchange is so limited that these mechanisms could be considered, for example, Cambodia, Lao P.D.R., Sri Lanka, Viet Nam, and selected South Pacific islands. Trust funds might also be appropriate in Asia under very specific circumstances for the protection of individual sites of global significance.

The World Bank and Biodiversity Conservation



Although the Bank's biodiversity conservation activities are still in early stages of development, the past five years have seen substantial growth in policies and sector work related to biodiversity and in the preparation and implementation of biodiversity components within larger natural resource projects. This growth has resulted from increasing international recognition and concern for the importance of biodiversity conservation, evolving Bank policies, and an increasing availability of grant funds for project preparation and implementation. The recent establishment of the GEF is expected to contribute significantly to future support for biodiversity activities.

Existing Bank Policies

As the Bank's interest in supporting environmental projects has grown, so has its interest in biodiversity conservation. A Bank-wide biodiversity task force was formed in 1987, and since 1988 regular meetings, which included both the Asia Environment Division of the World Bank and conservation NGOs, have been held on Investment Priorities for Biodiversity Conservation in the Asia-Pacific Region.

In support of general policy guidelines included in "Environmental Aspects of Bank Work,"² a number of Bank directives have been issued to guide project preparation and implementation in the area of biodiversity conservation. The most important of these are the Wildlands Policy Paper of 1986,³ and the 1989 Environmental Assessment Operational Directive,⁴ which was reissued in 1991. The recent Forest Sector policy paper is also expected to have a significant impact on the Bank's contribution to natural forest management (World Bank 1991).

Wildlands Policy. The Bank's wildlands policy paper states that "the World Bank will not finance any project that would convert wildlands of special concern." This includes existing and proposed protected areas, endangered ecosystems, habitats containing rare or endangered species, and areas that are important for wildlife breeding, feeding, or resting. This policy also states that the Bank prefers to site projects on already-converted natural habitat such as logged forests, cultivated lands, and degraded lands. In exceptional situations where conversion of wildlands is justified, it is suggested that a wildland management component supporting the conservation of areas similar to that being converted be included in the project as compensation (Ledec and Goodland 1988).

Environmental Assessment. The World Bank's Environmental Assessment Operational Directive requires the systematic screening of all World Bank projects for environmental impacts. Project screening and subsequent environmental assessments must consider the possible negative effects of projects on biodiversity, and where such impacts exist, mitigating actions must be proposed. Environmental assessments have led to the inclusion of biodiversity protection components in many projects. For example, special measures are being taken to protect fish and wildlife as part of large dam projects in China, India, and Nepal; and an oil palm development project in Papua New Guinea contains a component to protect an endangered species of birdwing butterfly and its habitat.

Forestry Policy. The recent Bank publications, *The Forest Sector* (1991) and *Strategy for For-*

Box 11. Selected World Bank Economic and Sector Studies Covering Biodiversity Concerns

Philippines Environment and Natural Resource Management Study (1989). This report analyzes policies related to logging and land use that have contributed to the massive loss of forest cover and accompanying biodiversity in the Philippines. It recommends expansion and strengthening of the protected area system, which now covers only 2 percent of the land area, and stresses the underlying need for significant policy changes, more equitable land distribution, and increased participation of local communities in protected areas management (World Bank 1989a). These recommendations have formed the basis of a World Bank SBAL for Natural Resources Management, which includes a component on the establishment and implementation of an Integrated protected areas system.

Indonesia Sustainable Development of Forests, Land and Water (1990). The Indonesian government has legally set aside some 10 percent of its forest land as reserves and 30 percent for watershed protection (nearly 500,000 square kilometers). Very little of this, however, is under secure or effective management. The Bank paper makes a number of recommendations to improve logging practices and stimulate plantation development to reduce pressure on the natural forest, and recommends policies to encourage more intensive land use in the less densely-populated Outer Islands (World Bank 1990a). It also recommends institutional changes and more effective funding for a nation-wide conservation effort. Some of these recommendations are reflected in the Second Forestry Institutions and Conservation Project and in the National Biodiversity Action Plan, financed by the Norwegian government (BAPPENAS 1992).

Sri Lanka Environmental Action Plan (1991). The Plan analyzes the factors contributing to deforestation and loss of biological diversity and recommends specific policy reforms and institutional strengthening as well as programs for training, research, education and public awareness, possibly with GEF financing. Specific initiatives for biodiversity protection are recommended, including improved protected area coverage, particularly for moist forest and coastal habitats, incentives for community resource management, enhanced private-sector participation in nature-based tourism, and specific programs for conservation and management of the elephant. These are now embodied in a recently published National Environmental Action Plan 1992-1996, the first comprehensive time-phased environmental planning document for Sri Lanka (Sri Lanka Ministry of Environment and Parliamentary Affairs 1991).

China Environmental Strategy Paper (1992). This report concludes that much of China's natural ecosystems outside protected areas, particularly wetlands and grasslands, may be lost during the next few decades as a result of population increases and accelerating economic development. Protected areas that are poorly managed could also disappear. The report examines the causes and consequences of this situation, assesses responses, and offers recommendations. Given the institutional complexity of the country, which has been a major obstacle to resource mobilization, it recommends development of a biodiversity action plan to identify the priorities for conservation, including appropriate institutional support; it also recommends the immediate strengthening of existing protected areas (World Bank 1992a). A biodiversity action plan is now being developed with financing from the GEF.

est Sector Development in Asia (1992b), reflect a greatly expanded Bank emphasis on biodiversity conservation in tropical forests. Under these policies the Bank will support initiatives to expand forest areas allocated as parks and reserves and to institute effective management and enforcement in new and existing areas. In particular, the Bank will assist governments in the preparation and implementation of conservation plans. The Bank will stress new approaches to management of protected areas that incorporate local people into protection, benefit sharing, and planning,

and will highlight the need to consider the requirements and welfare of forest-dwelling people. Experimental programs will also be financed to test alternative approaches to the participation of local people and to test the promotion of non-wood products of natural forests to benefit such people.

Strategy for Forest Sector Development in Asia emphasizes the need for comprehensive reforms in the institutional and incentive framework in which forest resource allocations are made in Asia. The Bank describes how it will assist gov-

ernments to recognize the range of values—economic, environmental and social—that are served by the forest resource and to put into place improved policies and procedures in the sector. Reduced pressure on the resource base will be achieved by enhanced rent capture by governments, improved control of forest land and agricultural intensification outside of forest areas, thus supporting efforts to protect biodiversity. The Strategy recognizes that the broad demands now being placed on forestry for conservation, for protection of forest-dwelling people, and for improvements in the lives of women and children, will require the forestry sector to draw on new and nontraditional implementation skills.

Economic and Sector Studies

As noted in Chapter 4, economic policies are critical to effective biodiversity protection and international agencies can play an important role by helping governments analyze the impacts of these policies on the environment, including biodiversity. The Philippine Sector Adjustment Loan (SECAL), which was approved by the World Bank in 1992, is a recent example of this kind of analysis.

World Bank sector studies in the Asia-Pacific region have also addressed biodiversity issues in the Philippines, Indonesia, Sri Lanka, China, and the South Pacific. The coverage and main findings of four of these reports are shown in Box 11.

Although the Tropical Forest Action Plan (TFAP) has not lived up to the expectations of the founding parties (Winterbottom 1990), the TFAP process has highlighted the need for biodiversity conservation in the context of overall forest management. For example, in 1989 the government of Papua New Guinea requested a forest sector review and action plan, and based on the findings of the resulting TFAP Forestry Sector Review, a National Forests and Conservation Program (NFCAP) was implemented. The program proposes a challenging agenda for forest protection and conservation: establishing a national forestry authority, strengthening the capacity of the Department of Environment and Conservation, conducting an initial survey of forest and biological resources, and developing mechanisms for involving NGOs and landowners in the management of forests and biological diversity. The plan has also mobilized technical and financial support of donors and international NGOs (Srivastava and Butzler 1989).

The World Bank led the TFAP preparation exercise in Papua New Guinea and has participated in TFAPs in Lao P.D.R. and Viet Nam that were led by the United Nations Development Programme (UNDP). The Bank has also undertaken major sector work on forestry in Sri Lanka, Indonesia, Malaysia, and India, and in all cases biodiversity protection was considered.

In parallel with the formal Bank sector work in the region, biodiversity profiles—which identify the status of biological resources and evaluate options for their conservation—have been prepared for Myanmar, the Philippines, Sabah and Sarawak, and a number of South Pacific island countries by the World Conservation Monitoring Centre (WCMC). These studies are complemented by a number of Biodiversity Action Plans that have been initiated under the GEF.

The Global Environment Facility

The GEF is a pilot program to assist developing countries to contribute toward solving global environmental problems (see Appendix C). The three-year experiment provides grants for investment projects, technical assistance, and to a lesser extent, research on protecting the global environment and transferring environmentally friendly technologies. The facility's work falls into four main areas: biological diversity, global warming, international waters, and depletion of the ozone layer. Responsibility for implementing the GEF is shared by UNDP, UNEP, and the World Bank.

Since the call for GEF proposals in December 1990, governments, implementing agencies, and NGOs have proposed a wide variety of technical assistance, training, and investment projects, particularly in the area of biodiversity protection. At this time, ten biodiversity proposals totaling \$100 million–\$110 million have been provisionally accepted or are under review in the Asia-Pacific region and three more may be submitted (see Appendix Table C). If this pipeline develops as planned, there will be at least one biodiversity initiative in most countries in the region, with the exceptions of Bangladesh, Cambodia, and the Democratic People's Republic of Korea and the Republic of Korea (both eligible for GEF). Projects such as the Bhutan Trust Fund, Viet Nam Protected Areas Conservation, Philippines Conservation Management of Priority Protected Areas, and Sri Lanka Wildlife Conservation and Protection were identified before GEF resources became available and all are well advanced.

Table 12. World Bank Projects with Biodiversity Components

Region or Country	Fiscal Year	Project	Component	Conservation Component Cost (millions of dollars)	Total Project Cost (millions of dollars)
Bangladesh	1992	Forestry III	Protection of Sundarbans mangrove forests and establishment of a wildlife conservation unit in the central government.	4.0	58.7
China	1992	Tarim Basin	Establishment of ecological surveys and protection of natural forests.	4.6	216.6
Indonesia	1988	First Forestry Institutions and Conservation	Strengthening the management of five protected areas.	29.7	63.0
Indonesia	1991	Second Forestry Institutions and Conservation	Strengthening the management of ten national parks; wetlands conservation; and provision of an advisory team to the Ministry of Forestry.	3.0	33.1
Indonesia	1993-94	Integrated Swamps	Protection of key wetland sites.	up to 10.0	55.0
India	1992	Maharashtra State Forestry	Establishment of a protected areas system; institutional strengthening; ecodevelopment; notification and legal settlement for priority protected areas.	7.2	124.0
India	1992	West Bengal Forestry	Conservation of biodiversity, including protection of rhino, leopard, and wetlands.	1.0	65.0
India	1993-94	Narmada Basin Development	Management planning for wildlife sanctuaries.	2.0	160.0
Malaysia	1990	Sabah Land Settlement and Environmental Management	Strengthening of wildlife reserve management and wildlife department; preparation of Sabah Conservation Strategy.	1.8	216.0
Pakistan	1993-94	Environmental Protection and Resource Conservation Project	Institutional strengthening of federal and provincial environmental protection agencies and natural resource rehabilitation, including rangelands and wildlife populations.	1.5	62.3
Papua New Guinea	1992	Oro Smallholder Oil Palm Development	Protection of the endangered Queen Alexandria butterfly habitat and strengthening of Department of Environment and Conservation.	2.5	36.8
Sri Lanka	1990	Forest Sector Development	Establishing an environment unit within the Forest Department; developing a database; drafting environmental guidelines for conservation areas.	1.3	31.4
Regional	1988-92	Strengthening the Conservation Management of Critical Ecosystems in the Asia-Pacific Region	Strengthening training and establishing of a regional post-graduate training program in biodiversity conservation.	0.6	0.6

Note: See also Appendix Table C for GEF biodiversity projects in which the World Bank participates.

Box 12. Selected World Bank Projects with Biodiversity Components

Indonesia: Forestry Institutions and Conservation Projects I and II (1988 and 1991). The conservation component in the first project is intended to strengthen the management of five existing national parks. It supports technical assistance, staff training and facilities development, as well as a study of the feasibility of developing buffer zones around Indonesia's protected areas. The second project supports revision of the existing National Biodiversity Conservation Plan; development of management plans, with buffer zones included, for ten national parks; improvement of wetlands conservation; and strengthening of conservation institutions, particularly at the local level.

Malaysia: Sabah Land Settlement and Environmental Management Project (1990). The project provides technical assistance to implement an environmental management plan for the Dent Peninsula, which consists of dryland tropical rain forest with a broad fringe of swamp forests. It also supports, with the state wildlife department, strengthening the management of two wildlife reserves occupied by rhino, elephant, and wild cattle. The project is also assisting the preparation of a conservation strategy for Sabah, and establishing an environmental coordinating unit in the Federal Land Development Authority to improve environmental planning and management of agriculture projects.

Pakistan: Environmental Protection and Resource Conservation Project (1993-94). This project has two broad components: institutional strengthening and environment and natural resource rehabilitation. Under the first component, the project would help federal and provincial environmental protection agencies to introduce environmental policy considerations into public and private investment decisions, raise the awareness of policymakers and the public regarding the loss of Pakistan's environment and natural resources, and develop professional training in environmental planning and management. Under the second component, the project would undertake a series of subprojects to repair damage to watersheds,

rangelands, and wildlife populations. Nongovernmental organizations have contributed to the design of several subprojects, some of which emphasize community involvement and monitoring and evaluation of inputs, outputs and effects.

Papua New Guinea: Oro Smallholder Oil Palm Development Project (1992). A conservation program for the purpose of ensuring the survival of the Queen Alexandra birdwing butterfly has been prepared in collaboration with international and national NGOs concerned with biodiversity conservation, and after consultations with landowners. The program also will provide a replicable model for integrating conservation with development in Papua New Guinea. The project's conservation component provides for critical short-term measures to ensure that new smallholder oil palm development does not further endanger the butterfly and its associated ecosystem. It would consist of mapping the distribution of the Alexandra birdwing, advising oil palm extension staff on the selection of land for oil palm development, promoting the establishment of permanent conservation areas that would remain under traditional land ownership but be subject to a ban on forest clearance, and training field personnel for the Department of Environment and Conservation. An Alexandra Birdwing Conservation Committee, consisting of NGOs, external donors, landowner representatives and government agencies, would be established to monitor implementation of the program and inform the government and donors on progress in achieving the conservation objectives.

Sri Lanka Forest Sector Development Project (1990). The environmental component of this project, which is being implemented by IUCN, includes establishing an environment unit within the forestry department; developing an environmental database; drafting environmental guidelines and procedures for forestry programs; and a review of existing management plans for 175 square kilometers of moist lowland tropical forests to determine whether these forests should be logged or set aside as conservation areas.

Pre-investment funds have been requested for the preparation of projects for China and Indonesia; projects are still in the identification stage in India and Thailand.

Operations vary in size from \$3 million to slightly over \$20 million and cover both technical assistance and investment activities. While UNDP is generally responsible for technical assistance

and the Bank for investment, many smaller projects are a blend of the two and the role of lead agency has been agreed on pragmatic grounds. For example, the Bank has no significant presence in the Pacific where UNDP has the lead.

Other cooperative efforts are supported by the GEF, as well. For instance, though all projects require government endorsement, NGO participation has been actively sought. In fact, NGOs have been heavily involved in the identification and preparation of all ten or so operations under way, and they have been consulted in the design of others, as well as on matters of policy and regional and national strategies. The GEF encourages further cooperation with multilateral development banks and the United Nations specialized agencies.

World Bank Projects with Biodiversity Components

Most biodiversity activities currently underway in the Asia-Pacific region with World Bank support, involve establishing and maintaining protected area systems as part of larger agriculture and natural resource projects. There are thirteen such project components in the pipeline in the five-year period from July 1988 through June 1993 (see Table 12). The project components include support for work such as compiling biological inventories and databases, preparing management plans, and providing infrastructure for specific protected areas. The components also include studies of needed policy changes and they provide guidance on the establishment of buffer zones and new financing mechanisms. In addition, a regional training program for management of protected areas has been started, as well as an environmental protection project in Pakistan. Box 12 describes five World Bank projects with biodiversity components and illustrates the range of interventions supported to date.

Including biodiversity conservation as a component of a larger Bank project has two important advantages. First, the larger project can often ad-

dress policy and institutional reform issues, thus providing a basis for linking conservation and economic development. Second, the larger project can provide the leverage needed to encourage governments, most of which have been reluctant to borrow for protected areas, to include a conservation component. The Bank has generally been able to attract grant co-financing for these conservation components, but the crucial issue of sustainability of the investment, particularly recurring costs, is only beginning to be faced.

The Bank's portfolio also includes one regional project intended to address the critical human resource constraints discussed in Chapter 3. Under this program, proposals have been developed to strengthen conservation training in Bhutan, Lao P.D.R., Myanmar, Papua New Guinea, and Viet Nam, and to establish a new regional post-graduate training program in biodiversity conservation at the Asian Institute of Technology in Bangkok. This work was financed by UNDP, executed by the World Bank, and subcontracted to WWF-U.S. and the Economic and Social Commission for Asia and the Pacific (ESCAP). GEF-Funding has been obtained for the Viet Nam and Lao P.D.R. proposals and other sources are being sought for the others. Once funding is received, these projects can begin to alleviate human resource constraints in the region and offset the shortage of training facilities.

Notes

1. Including the Technical Assistance Grant Program for the Environment, financed by the Government of Japan, and the Norwegian Trust Fund for the Environment.

2. Operational Manual Statement (OMS) 2.36, to be reissued as Operational Directive (OD) 4.00, "Environmental Policies."

3. Operational Note (ON) 11.02, "Wildlands: Their Protection and Management in Economic Development" (1986), to be reissued as OD 4.04, "Wildlands: Their Protection and Management."

4. Environmental Assessment OD 4.00, Annex A (1989), reissued as OD 4.01 (1991).

A Regional Strategy for Biodiversity Conservation



General Considerations

A regional strategy for protecting biodiversity must give highest priority to the countries of greatest biological diversity. However, within this general provision several caveats are in order.

First, since every country in the region has areas of international significance, most of which are under threat, national programs to protect biodiversity in all countries are critical. Because the value of threatened resources and their link to economic activity is uncertain and because nearly all countries require additional technical and financial support to protect their biological resources, a regional strategy should strive to identify and protect resources of national importance within every member country.

Second, investment in the region should generally focus on program development rather than on the protection of specific sites. Obviously, when sites of worldwide significance are identified, a major effort should be made to protect them. This is particularly important in countries with limited institutional capacity and limited commitment to protection of biodiversity, or in areas under very severe threat. In the Asia region in general, however, there is a widespread respect for nature and an emerging willingness to support conservation if social and financial obstacles can be overcome. Therefore, primary attention should be given to supporting policy change, strengthening institutional capacity, promoting linkages between smallholder development and conservation, mobilizing resources, and producing model projects rather than simply concentrating on protecting single sites.

Within these guidelines, countries will have widely varying needs and capacities. Conse-

quently, programs developed within each country will need to take into account the following:

- importance of the resource and degree of threat,
- availability of information,
- institutional strength and absorptive capacity,
- local conditions,
- ability to mobilize resources, and
- social and political factors.

National biodiversity action plans can be important for identifying priority areas for protection, uncovering harmful policies, and defining institutional and financial constraints. To be most effective, however, such plans should be broadly participatory, involving planning agencies, line agencies, NGOs, and the private sector, and they should seek to develop a commitment to protection efforts.

Priorities for Conservation

As noted, priority must be given to areas where there is both biological significance and a high degree of threat. Table 13 shows the countries in the Asia-Pacific region having the greatest biodiversity and large areas of natural habitat. As the table indicates, there are five countries in the region that are conspicuous for their number of species and endemics and therefore have the highest priority. These include the island rain-forest countries of Indonesia, Papua New Guinea, and the Philippines. China and India are also on this list because of their vast size and variety of habitat. Four smaller areas are also of importance: the Eastern Himalayas (Nepal and Bhutan), Eastern Malaysia and parts of Thailand, Sri Lanka, and the Pacific Islands. Cambodia, Lao P.D.R.,

Table 13. Priorities for Conservation

Country	High Number of Species	High Number of Endemics	High Number of Species or Endemics per Unit Area	Large Areas of Intact Natural Habitat
<i>Highest Priority:</i>				
Indonesia	x	x	e	x
China	x	x		
India	x	x		
Malaysia	x		s	x
Papua New Guinea	x	x	e	x
Thailand	x			
Philippines	x	x		
Nepal			s	
Bhutan			s	x
Sri Lanka			s	
Pacific Islands (all countries)			s	
Fiji			e	
<i>Secondary Priority:</i>				
Cambodia				x
Lao P.D.R.				x
Myanmar				x
Pakistan				x

Myanmar, and Pakistan appear on this list as secondary priorities because their biological resources and endemism are shared with a number of countries. However, these countries also have important areas for protection.

High Priority Rainforest Countries. Four countries—Indonesia, Malaysia, Papua New Guinea, and the Philippines—illustrate the range of conditions to be found in island Southeast Asian rainforests. The forest resources of the Philippines and Eastern Malaysia are severely threatened. Some areas of Indonesia are under intense pressure (Java and Bali), while others are relatively untouched (Irian Jaya). Though under pressure, Sarawak in Eastern Malaysia and Papua New Guinea still have large areas that could be protected. Information on biological significance is reasonably accurate and available in Indonesia, Malaysia, and the Philippines, but unclear and not readily accessible in Papua New Guinea. Institutions are weak throughout the region, but absorptive capacity is particularly limited in Papua New Guinea. Harmful government policies can be found in all of the countries, but the national land use policies of the Philippines have led to especially rapid losses of forested land.

Resources to accomplish conservation goals are available in varying degrees in the region, as well. Malaysia is comparatively wealthy and may have considerable potential for domestic resource mobilization. Indonesia could obtain significant financial resources from its own private sector if key constraints were overcome. In most of these countries national forests are under the control of Forestry Departments; but in Papua New Guinea and many other Pacific island countries, forested land remains under the legal control of local smallholders, thereby presenting unique challenges and opportunities. These physical and financial considerations countries suggest various approaches to biodiversity protection (see Box 13).

Mainland Asian Megadiversity Countries. In spite of highly visible internationally financed programs to protect popular species like the Bengal tiger and the panda, India and China receive a relatively small share of the international resources for biodiversity in relation to their size and biological diversity. There are a number of reasons for the disparity: in both countries, the area involved and the complexity of the problems are daunting, and pressure from poverty and

Box 13. Priorities for Biodiversity Conservation in the Island Rainforests of Southeast Asia

Indonesia. As Indonesia is the most important country in the region for the conservation of biological diversity, it has considerable potential to mobilize funding from international groups and the private sector. Chief constraints to conservation of biodiversity are: incentives to local officials to exploit rather than protect forests; smallholder encroachment; overcentralization and low status of staff; and an inability for bilaterals and the private sector to fund protected areas directly. Preparation of a national biodiversity action plan has been completed with broad participation of the scientific community and national and international NGOs. This has identified priority areas for protection, but it has not yet addressed needed policy changes. Policy studies on incentives, institutional development, and financing will be necessary prerequisites for effective investment.

Papua New Guinea. The biodiversity of Papua New Guinea is among the richest in the world but only thirty or so areas are protected, and those only nominally. About 85 percent of Papua New Guinea is forested and the forested land belongs to local smallholders. Review of the TFAP with interested NGOs and others indicates that insufficient attention has been given to the identification and demarcation of areas of the greatest biodiversity. Therefore, further effort is needed to assess biological resources, raise landowner awareness and involve them in the management of conservation areas, and develop alternative income generating activities to replace

logging in sensitive areas. This will be a very long-term initiative and is to be started with GEF financial support.

Philippines. The terrestrial and marine ecosystems of the Philippines have a high degree of endemism. However, the existing protected area system suffers from poor design and lack of the resources and personnel needed for effective management. Assistance is being provided to remedy these problems. So far, priority areas for inclusion in the protected area system have been identified, and new legislation for the system (now termed the Integrated Protected Areas System) has been passed by the congress. A GEF project has been formulated, based on management plans developed for the highest priority areas in the system, in which the most pristine of the remaining terrestrial, wetland, and marine areas are represented.

Malaysia. Malaysia has gazetted some 1.4 million hectares for parks or wildlife sanctuaries, and gazettement procedures are underway for an additional area of equal size. Therefore, reaching current targets, while substantially upgrading management capabilities is a major challenge. Preservation of biodiversity would be further served by reducing the rate of logging in the 44,000 square kilometers of remaining virgin forest. Recent sector work has analyzed the policy, incentive, and institutional structure in the Malaysia forestry sector and has proposed substantial improvements. Discussion with the Malaysian government is ongoing.

population is overwhelming. Under these circumstances individual donors are likely to feel they can have only limited impact. There are other difficulties, as well. For example, in China information about the protected area management system is not easily accessible to the West; and in both China and India, administrative decentralization compounds the problem of prioritization and comprehensive intervention.

On the other hand, both countries have a highly developed civil service and many skilled people who can be assigned to biodiversity protection programs. India also has numerous NGOs willing to lobby for political support and many activists with a clear understanding of the human and social dimensions of biodiversity protection.

In both China and India, there remains a need to bring various jurisdictions together at a national level to develop clear strategies. In China, as long-range plans are being worked out, immediate efforts could begin on areas of known importance (for example, the rainforests of Xishuangbanna). Similarly, in India, investment proposals could be developed for protected areas of known global significance, for example, in the Sundarbans and the Western Ghats. Then, the very serious and more general problem of human pressure on protected areas must be addressed, drawing on India's large NGO community and the experience of local people. Box 14 provides further discussion of the complexities involved in planning biodiversity strategies for each of these countries.

Small Countries with Species Richness. The third tier of countries in terms of their importance for biodiversity protection includes several small countries—Bhutan, Nepal, Sri Lanka, and the Pacific Islands—that nevertheless have globally significant biological resources. These countries are vastly different in their biogeographical setting, institutional development, and availability of human resources, but they are alike in having very limited resources for biodiversity protection, by virtue of their size and poverty or isolation. Thus, institutional and financial sustainability must be a major consideration in appropriate levels and types of investment.

Two countries, Bhutan and Nepal, are in the Eastern Himalayas, an area that is regarded as one of the world's biodiversity "hot-spots." Bhutan's government is strongly committed to conservation and about 45 percent of its area is

under forest. Nepal, on the other hand, under pressure from a population that has doubled in thirty years, has lost 40 percent of its natural forests and is entering a stage of crisis. Sri Lanka is ranked as having the second highest diversity of biological resources per unit area in the Asia region and for that reason, should receive priority planning. Finally, the islands of the South Pacific are important both because of their high degree of endemism, and also because island diversity in general is among the most critically threatened in the world. The status of biodiversity and appropriate interventions in each of these nations is discussed in Box 15.

Mainland Southeast Asian Countries. The countries of Southeast Asia have in common both biological resources and economic threats. The recent decision to halt logging in Thailand, for

Box 14. Priorities for Biodiversity Conservation in Mainland Asian Megadiversity Countries

China. Due to the biophysical, socioeconomic, and institutional complexity of the country, it has been difficult to determine priority conservation needs and identify appropriate recipient institutions. The lack of a comprehensive strategy for biological diversity conservation has also made it difficult for the government to allocate its scarce resources and has discouraged foreign assistance. (The international community has provided about \$3 million to China over the last ten years for conservation activities other than for panda protection.) Since the low level of funding is a major constraint to biodiversity protection in China, the Chinese need to attract support by consolidating information on biodiversity, determining priority conservation needs, and identifying the responsible institutions. To do this, a national biodiversity action plan, based on existing Chinese information is needed. Where there is already a broad consensus on priority areas for protection (for example, the rainforest areas of Xishuangbanna in Southern Yunnan Province), detailed preparation could also begin. This would allow feedback from preparation of investment activities to modify the biodiversity action plan, and it would speed up work on priority areas. The plan should also address institutional arrangements for coordinating the highly-fragmented protected areas system.

India. Like China, India has a large protected area system administered by state government agencies. Protected areas receive low levels of funding and all are subject to human encroachment. Although much work has already been done, it will be important to prepare or consolidate protected area action plans at the state and central levels in order to mobilize donor support and GEF assistance. Preparation of investment proposals should also be developed for areas of global significance, for example, the Sundarbans, Western Ghats, and the Northeast. There is an urgent need to find ways to manage protected areas sustainably in the face of current pressures. Specific programs are needed for extension and improvement of the protected area coverage; concerted efforts are needed for inclusion of biodiversity in management of multiple use forest lands, particularly neighboring protected areas; and mechanisms are needed for increasing benefits to the associated local communities.

No country in the region has more need for a strategy for dealing with people in protected areas than India, nor is any country better equipped to prepare it. For this reason, it may be particularly effective to give serious consideration to the preparation of ICDFs with emphasis on participation of local communities in the design and implementation of the project and major involvement of appropriate NGOs.

Box 15. Priorities for Biodiversity Conservation in Small Countries with Species Richness

Bhutan. Both Bhutan and Nepal are included in an area regarded as one of the world's biodiversity "hot-spots," the Eastern Himalayas. Of the two, Bhutan is far better off with about 45 percent of its land under forests, compared to 15 percent in Nepal. The Royal Government of Bhutan (RGOB) is strongly committed to conservation and has set aside 20 percent of its land area and .29 percent of its government budget for protection—higher than any other country in Asia. However, with a small population and a limited natural resources base, government revenues are modest, with priority investments given to social programs. To fulfill funding needs, the RGOB, with WWF-U.S. support, has established a Trust Fund to be administered by UNDP. The RGOB is seeking \$20 million, half from the GEF, to support a biodiversity conservation program. Given the severe constraints on resources in Bhutan and the demonstration value of a trust fund of this type, such an approach should have strong support.

Nepal. Nepal has ecosystems similar to those in Bhutan and India and is highly dependent on its natural beauty and biodiversity for tourism and revenue. However, in the thirty years the country has had modern health care and development, the population has doubled and 40 percent of its forests have been cleared or are seriously degraded. Despite an impressive network of parks, numerous studies, and dynamic NGOs, biodiversity in Nepal is entering a stage of crisis. The major issues are lack of financial resources; poor relations between park authorities and local people; and conflicts between tourism and conservation. Effective strategies include strengthening key institutions, promoting local participation, and channeling a larger share of tourism revenues to biodiversity conservation.

Sri Lanka. Although some 12 percent of the total land area in Sri Lanka is protected areas, only 1 percent is located in the wet lowland and mountain regions—areas of highest diversity. Moreover, the existing protected areas are mostly paper parks. The major constraints to biodiversity conservation are the shortage of adequately trained staff and funds, both conditions worsened by recent civil strife (Jansen and Loken 1988). To address these deficiencies, the Department of Wildlife Conservation has formulated a five-year Wildlife Plan and a Wildlife Policy, which was recently approved by the cabinet. Financing for part of the Plan has been obtained from the GEF. In addition, the Bank is assisting in the review of the wet tropical forest zone to determine which areas should be set aside and which areas can be managed sustainably for production.

South Pacific Islands. This area is renowned for its high degree of endemism, attributed to the isolated evolution of island species. Species diversity is greatest on the larger continental and high islands of the western Pacific, but endemism is greatest in the east. This rich island biodiversity is among the most critically threatened in the world. Because of the small size of many of the countries of the South Pacific and the lack of technical expertise and resources, strengthening regional cooperation—for example, by financing programs coordinated by the South Pacific Regional Environment Program (SPREP)—is likely to be the best means of achieving biodiversity conservation. Also, an important factor for sustaining any biodiversity conservation effort in the Pacific is the involvement of local landowning groups. The unique patterns of customary ownership of land and resources, much like communal and private ownership, dictate that projects must foster close cooperation with the rural communities

example, has had a devastating effect on Myanmar and a significant impact on Lao P.D.R. and Cambodia by causing logging companies to move into these countries. Under these circumstances it is critical to evaluate logging, deforestation, and biodiversity protection on a subregional basis.

In other respects, however, the countries are very different. Cambodia, Myanmar, and Lao P.D.R. are still reasonably forested but provide little protection to biodiversity. Viet Nam has high population densities in many areas and forests devastated by war and smallholder cultivation.

With extremely low per capita incomes, none of these countries have resources for biodiversity protection. On the other hand, the forests of Thailand and peninsular Malaysia face severe threat from the economic development that could generate the resources for conservation. Box 16 discusses in detail the status of programs in each of the mainland Southeast Asian countries.

South Asian Countries. Predominantly arid and semi-arid, Pakistan has a modest forest resource base with most of its remaining wildlife

Box 16. Priorities for Biodiversity Conservation in Mainland Southeast Asian Countries

Cambodia. Cambodia has a wide range of habitat types that harbor a number of endemic plants and animals, notable of which is the Koupriy (a large mammal). Very little information on biodiversity is available due to the continuing political unrest, but with improved political conditions, biodiversity surveys should be initiated with a view to formulating a biodiversity action plan. In parallel, to save at least representative samples of habitat, a protected areas system should be formulated along with appropriate legislation. Establishment of a comprehensive training program to develop institutional capabilities for biodiversity conservation will also be required.

Lao P.D.R. Lao P.D.R. has a rich diversity of species and ecosystems representing part of four biogeographic subunits. Unlike its neighbors, Thailand and Viet Nam, Lao P.D.R. still retains large tracts of relatively undisturbed forest cover (roughly 30–35 percent). However, these forests are under increasing pressure from commercial exploitation and, in some locations, a growing population. At present, Lao P.D.R. does not have a system of protected areas, nor does it have the legal, institutional, and policy framework for establishing such a system. An IUCN study has identified sixty-eight sites of high and moderate conservation priority, including four historical/cultural sites and five wetlands. Covering an area of 29,000 square kilometers, 12.4 percent of the total land area, these sites are sufficient for general conservation objectives. However, given the extremely limited local resources to establish protected areas and the severe lack of trained staff, the development of a conservation program in Lao P.D.R. will require long-term commitments from the Lao government, international agencies, and bilateral and multilateral funding communities. The upcoming Bank Forest Management and Conservation Project will begin to address the needs of biodiversity conservation through training, institutional strengthening, and protected areas development.

Myanmar. One of the richest biological reservoirs in Asia, Myanmar also has a history of practicing sustainable selective logging and replanting its valuable forests. Unfortunately, the conservation of biodiversity has received very little attention, and among this richness are many species of special value: the wild relatives of domestic species such as jungle fowl, pig, cattle, rice, citrus, and tea. Threats to these resources are logging and population pressure and its attendant problems. In addition, Myanmar has yet to develop an environmental strategy and pro-

ected area system. A GEF-funded, UNDP project of \$3.9 million will focus on the sustainable development of all natural resources and the conservation of natural ecosystems and will include institutional strengthening and demonstration projects.

Thailand. Thailand's forest resources and associated biological diversity are suffering rapid depletion. Forest cover decreased from 53 percent of the country's total area in 1961 to 28 percent in 1988 and, by some estimates, will decrease to 20 percent in the early 1990s. To address this problem, the Royal Thai Government declared a twenty-point National Forest Policy in 1985, to improve the management and development of the national forest. In spite of this policy, substantial destruction of the forest continued—with associated problems of landslides and flooding. After a particularly severe storm in 1989, the government imposed a total ban on logging and revoked logging concessions throughout the country. However, the problem of forest encroachment has yet to be adequately understood and is currently being studied. The findings of the study will be incorporated into the Bank's forthcoming Forest Area Protection, Management and Development Project. GEF funding will be sought for the biodiversity component of this project.

Viet Nam. The natural environment continues to be in a critical state in Viet Nam. Forest cover was halved during the war years, two million hectares of forests being lost to chemical defoliants alone. Other large areas were cleared by bulldozers, napalm, and saturation bombing. Uncontrolled logging, high population growth in forested areas, and slash-and-burn agriculture have also contributed to deforestation. Remote sensing data indicate that about two million hectares of primary forest remain, with current losses estimated at 2,500 square kilometers per year. Fragmentation of forest tracts and uncontrolled hunting have caused the extinction of a number of rare species of birds and mammals. To save the remaining areas of ecological and environmental significance, the government has proposed an extensive network of forest reserves and national parks covering 3 percent of the total land area. The establishment and protection of these reserves is severely constrained by poorly-defined institutional structure and lack of adequately trained staff and funds (MacKinnon 1990, and Vo Quy and others 1991). To develop the human resources necessary to carry out conservation activities and to identify investment opportunities, the GEF will fund a comprehensive conservation training program and the development of a biodiversity action plan.

found in the mountainous country west of the Indus. The two regions of outstanding importance are the Himalayan and Karakoram Massifs in the extreme north and the desert in the south-west. A recent review of critical ecosystems in Pakistan identified the Indus riverine zone and the Chagai Desert and juniper forests of Baluchistan as areas of ecological interest and conservation importance internationally (Roberts 1986). However, protected areas have been created haphazardly, often without criteria for their selection and with boundaries marked according to little or no ecological reasoning. While most major habitats are represented within the existing protected area system, a national review has never been conducted. Clearly, this is a priority in planning the further development of Pakistan's protected areas network.

In Bangladesh, the threat to biodiversity is intense. Only 6 percent of its land remains in unmodified ecosystems and even that is under tremendously high population pressure (Alcor and Johnson 1989). In addition, political commitment, institutional capabilities, and absorptive capacity of the country are very low, so achieving much over the short term will be extremely difficult. Under these circumstances, the focus will be site-specific, concentrating on management and protection of the Sundarbans mangrove swamp, a site of global significance, as well as institutional strengthening (IUCN 1991).

Demonstration Effects

Three major objectives have been identified as critical to any program for protecting biodiversity throughout the Asia-Pacific region:

- modifying policies with adverse impacts on biodiversity,
- reconciling the needs of local people with the need to protect areas, and
- ensuring the sustainability of investments.

Policy Change. Inappropriate national policies, laws, and regulations can result in unsustainable and inefficient natural resource use can contribute unnecessarily to the loss of biologically significant natural habitats and species. Areas where policy change is required are in forestry (Fiji, Indonesia, Lao P.D.R., Malaysia, Myanmar, and the Philippines) and land use policy (Indonesia, Papua New Guinea and the other

Pacific island nations, the Philippines, and Thailand). The agricultural policies of countries that affect forests directly by encouraging their conversion to agricultural crops (including tree crops) and that might have a positive impact on shifting cultivators, should be reviewed.

Participation. Three countries in the region are particularly well suited for demonstration projects intended for reconciling the needs of people and protected areas.

- Indonesia, because of its importance for biodiversity and its very large foreign-assisted development program, should have high priority for the preparation of ICDPs.
- India, because of its strong participatory process and active NGOs, could demonstrate a project designed by NGOs with full participation of the local people.
- Papua New Guinea, with some 97 percent of its land under customary ownership, provides a unique opportunity for cooperative partnership between landowners, resource users, and the government.

Sustainability of Investments. Two main approaches to the problem of sustainable financial flows can be suggested:

- increase domestic resource mobilization, through natural resource taxes and levies, development and conservation linkages, and charges for private sector use; and
- attract international transfers through direct aid or endowments or trust funds.

Several countries in the region have the potential to significantly increase funding for biodiversity through development activities (for example, power generation), forest development, and ecotourism, and through private sector support. Indonesia, Malaysia, Thailand, and possibly Papua New Guinea provide the best opportunities to demonstrate ways to increase domestic funding through the taxation of forestry, mining, and other development projects that diminish biodiversity, and initiatives to support this should be tried in these countries. Bhutan, Indonesia, Malaysia, Nepal, and Thailand also have considerable potential for partial financing biodiversity protection from tourism revenues. Over the next few years, efforts should be made to tap

these resources to ensure long-range biodiversity funding.

Endowments or trusts cannot be expected to be a major source of conservation funding in Asia because of the large resources needed to protect biodiversity and the large amount of capital they tie up in relation to that available. However, there are several countries whose access to local resources and foreign exchange is so limited that consideration of these mechanisms makes sense. These countries include: Bhutan, Cambodia (should work there be possible), Lao P.D.R., Viet Nam, Sri Lanka, and selected South Pacific islands. Trust funds might also be appropriate under very specific circumstances for the protection of sites of global significance. This paper recommends that the GEF establish trust funds in highly selected areas and monitor them closely; otherwise, trust funds should be avoided.

Gaps and Regional Priorities

Clearly, more information about ecosystem dynamics and economic valuation, and in general, more attention to the probable loss of biological resources, is needed.

Economic Policies Affecting Biodiversity Protection. Although this paper has examined a number of national policies that have an adverse impact on biodiversity, economists can provide more expert analysis and advice. This is particularly true where resource deterioration may be due to a combination of many factors working off-site; for example, where the loss of biodiversity in coastal and marine zones or wetlands is caused by use of pesticides, industrial pollution, soil erosion in upland watersheds, and so forth. Environmental action plans and other country and economic sector studies will be essential to analyzing the policy forces behind biodiversity loss and to identifying specific reforms for reducing the threat or creating incentives to conserve.

Ex-Situ Protection of Biodiversity. *Ex-situ* conservation is important to protecting a small but often critical part of biodiversity through seed banks (germplasm), zoos, and botanical gardens (Hoyt 1988). However, the number of species maintained in living collections is limited by the size of the facilities and the relatively high maintenance cost per species. The Bank is already involved in *ex-situ* protection through support of

the CGIAR, and a study of how those efforts can best support *in-situ* methods would be useful (CGIAR 1992).

Biodiversity Databases. There is an urgent need to establish or strengthen in-country user-friendly biodiversity databases for analysis of conditions and trends and for use in development decisionmaking. Equally, there is a need to create a network for exchanging information at the regional level and with international conservation bodies. Such activities would help identify gaps in the coverage of species, habitat and protected areas and determine conservation priorities for action at the country level. A time-related monitoring system should also be developed to measure trends and to provide early warning to national and local level decisionmakers.

Public Awareness. A critical component of biodiversity protection will be the expansion of public awareness and concern about its importance and value. This will necessitate education and awareness campaigns by governments to motivate people and gain their support for conservation. Extension workers and education specialists should be trained to disseminate information to farmers, fishermen, forest workers, the urban and rural poor, and other groups about the importance of sustainable use of biological resources.

Nongovernmental organizations and advocacy groups can also help governments raise public awareness and concern. To realize this objective, however, actions will be needed to strengthen developing country NGOs and to promote their direct participation in decisionmaking on biodiversity policy and planning.

Wetlands and Marine Conservation. Most country conservation programs indicate a growing awareness of priorities for the conservation of terrestrial areas. However, nearly all reviews acknowledge a dearth of information about inland and coastal wetlands and marine areas which are facing increasing threat. It is clear that unless a major program of action is initiated in the next five years, a significant proportion of the wetland resource will be lost in many parts of the region. Equally critical is action to develop means to conserve marine ecosystems. Most governments in the region are aware of their rapidly diminishing marine biodiversity, particularly coral reefs,

but they lack the expertise to set priorities and guide recovery. The matter is further complicated by the fact that natural marine boundaries seldom correspond to territorial borders, the health of a country's marine environment being frequently dependent upon the condition of its neighbor (Thorne-Miller and Catena 1991). A regional initiative is therefore desirable to identify areas of significant species richness and endemism and to develop integrated management plans for their sustained conservation. The participation of artisanal fishermen and other coastal inhabitants is crucial to ensuring improvements in local management of coral reef and reef-related activities (White and Savina 1987).

Subregional Strategy for Mainland Southeast Asia. For Myanmar, Lao P.D.R., Viet Nam, and (eventually) Cambodia, given the similarities in

culture, ecological conditions, stage of economic development, and the clear need for sustained long-term external assistance, a multi-country biodiversity program might be more effective. This program should emphasize human resource development, transboundary reserve development, establishment of collaborative biological inventories and monitoring systems, and development of funding mechanisms to sustain conservation activities over the long-term. Though Thailand is far ahead of its neighbors in available trained staff and financial resources, its biodiversity is disappearing rapidly and certain policies of the Thai government, for example, the logging ban, are having a detrimental impact on the biological resources of its better endowed neighbors. A regional study of the impacts of policies on biodiversity protection would be useful in this case.

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Table A.1. Country Data: Asia-Pacific Region

<i>Country</i>	<i>Area (hundreds of square kilometers)</i>	<i>Population (millions)</i>	<i>Population Density (per square kilometer)</i>	<i>Per Capita GNP (dollars)</i>	<i>Growth Rate of Population (percent)</i>
Bangladesh	1,440	108.9	756	170	2.4
Bhutan	470	1.4	30	150	2.4
Cambodia	1,810	8.2	45	<500	2.1
China	95,610	1,088.4	114	330	1.3
India	32,880	815.6	248	330	1.8
Indonesia	19,050	174.8	92	430	1.7
Korea, Republic of	990	42.0	424	3,530	0.9
Lao P.D.R.	2,370	3.9	16	180	2.9
Malaysia	3,300	16.9	51	1,870	2.2
Maldives	3	0.2	677	410	3.4
Myanmar	6,770	40.0	59	<500	2.1
Nepal	1,410	18.0	128	170	2.5
Fiji	180	0.7	41	1,540	1.9
Kiribati	10	0.1	96	650	1.9
Solomon Islands	270	0.3	11	430	3.7
Tonga	7	0.1	144	800	1.4
Vanuatu	120	0.2	13	820	3.2
Western Samoa	30	0.2	56	580	1.0
Papua New Guinea	4,630	3.7	8	770	2.2
Pakistan	7,960	106.3	134	350	3.2
Philippines	3,000	59.9	200	630	1.9
Sri Lanka	660	16.6	252	420	1.1
Thailand	5,130	54.5	106	1,000	1.3
Viet Nam	3,300	64.2	195	<500	2.0

Source:

Area: World Bank 1990b for all countries except Fiji, Kiribati, Maldives, Solomon Islands, Tonga, Vanuatu, and W. Samoa, for which the source is WCMC 1992.

Population: World Bank 1990b for all countries except Fiji, Kiribati, Solomon Islands, Tonga, Vanuatu, and W. Samoa, for which the source is World Bank 1989b; and Cambodia, for which the source is WRI 1990.

Per capita GNP: World Bank 1989b. Data are for 1988.

Growth Rate: World Bank 1990b. Data represent projected growth rates of the population during the period 1988–2000.

Table A.2. Protected Area Systems in the Asia-Pacific Region

Country	Loss of Original Habitat (percent)	Number of PAS over 10 square kilometers	Land Area under Protection (square kilometers)	Percentage of Country under Protection	Percentage of WII under Some Protection	Number of Marine PAS	Comprehensiveness of PAS Coverage	Effectiveness of PAS Management
	(1)	(2)	(2)	(2)	(3)	(4)	(5)	(5)
Bangladesh	94	8	968	0.7	9	0	L	L
Bhutan	34	5	9,061	19.4	77	n.a.	H	L
China	—	396	283,578	2.9	13	27	L	L-M
India	80	362	137,701	4.3	30	22	M	M
Indonesia	49	194	192,309	10.0	35	8	M	M
Cambodia	76	0	0	0	<1	0	L	L
Korea, Republic of	—	26	7,568	7.7	—	19	—	—
Lao P.D.R.	71	0	0	0	0	n.a.	L	L
Malaysia	41	51	14,880	4.5	53	13	H	M
Maldives	—	0	0	0	—	0	L	L
Myanmar	71	2	1,733	0.3	<1	0	L	L-M
Nepal	54	13	11,260	8.0	77	n.a.	L-M	M
Fiji	—	2	53	0.3	—	0	L	L
Kiribati	—	3	266	38.9	—	0	M-H	M
Solomon Islands	—	0	0	<1.0	—	0	L	L
Tonga	—	0	0	<1.0	—	6	L	L
Vanuatu	—	0	0	<1.0	—	1	L	L
Western Samoa	—	0	0	1.0	—	0	L	L
Pakistan	76	53	36,550	4.5	61	0	L-M	L-M
Papua New Guinea	—	5	290	0.1	6	6	L	L
Philippines	79	27	5,729	1.9	7	8	L	L
Sri Lanka	83	43	7,837	11.9	30	3	M	L-M
Thailand	74	90	55,140	10.7	8	15	H	M
Viet Nam	80	59	8,975	2.7	1	1	L	L

PAS Protected areas.

WII Wetlands of International Importance

PAS Protected Area System.

— Data not available.

n.a. Not applicable.

L Low.

M Moderate.

H High.

Source:

(1) MacKinnon and MacKinnon 1986; WCMC 1992.

(2) IUCN 1990; WCMC 1992.

(3) Scott and Poole 1989.

(4) World Bank data.

(5) Derived from MacKinnon and MacKinnon 1986; WCMC 1990; and various World Bank country-level studies.

Table A.3. Management Costs for Protected Areas

<i>Name of Protected Area</i>	<i>Country</i>	<i>Area (km²)</i>	<i>Annual Operating Budget (dollars)</i>	<i>Annual Costs (per km²)</i>
Wolong Nature Reserve	China	2,000	363,500 (S & O) * (65,000 – O only)	182
Gunung Leuser	Indonesia	10,946	232,357	21
Baluran	Indonesia	279	187,172	671
Bali Barat	Indonesia	772	159,527	207
Shwe Settaw G.S.	Myanmar	552	144,000 (S & O)	261
Kathapa N. Park	Myanmar	1,607	143,600 (S & O)	89
Dumoga Bone	Indonesia	2,780	136,874	49
Chatthin G.S.	Myanmar	268	134,000 (S & O)	500
Khao Yai N. Park	Thailand	2,169	131,300 (S & O)	61
Gede Pangrango	Indonesia	152	120,714	794
Komodo	Indonesia	407	111,817	275
Cat Ba N. Park	Viet Nam	150	108,000 (S & O)	720
Ujung Kulon	Indonesia	786	90,274	115
Makulu-Barun	Nepal	1,250	85,000 (S & O)	68
Cuc Phuong N. Park	Viet Nam	2,300	83,300 (S & O)	36
Kerinci Seblat	Indonesia	14,847	79,606	5
Tanjung Puting	Indonesia	3,552	68,639	19
Khao Soi Dao W.S.	Thailand	745	63,000 (S & O)	85
Thale Noi	Thailand	457	58,087 (S & O)	127
Baishuijiang Nature Preserve	China	2,000	54,300 (O only)	—
Foping Nature Preserve	China	290	54,000 (O only)	—

* Staffing and Operations.

— Data not available.

Source: See Appendix A notes.

Lists of Important Sites for Biodiversity Conservation

1. Centres of Plant Diversity in Asia (IUCN Plant Conservation Office 1990)

Southeast Asia		Philippines	
Malaysia (Peninsular)	Endau-Rompin		Lowland rainforest of Sibuyan Island
Malaysia (Peninsular)	Limestone flora	Sulawesi	Limestone flora
Malaysia (Peninsular)	Montane flora (Possible candidates: Cameron Highlands, Genting Highlands, Fraser's Hill, and Kedah Peak.)	Sulawesi	Lore Lindu National Park
		Sulawesi	Ultramaphic flora (possibly Morowali National Park)
Malaysia (Peninsular)	Northwest Peak Region (Possible candidates: Gunung Bubu in Perak, Pangkor Island, Kedah, the Segari Melintang Forest Reserve, part of Penang, and the Dindings area.)	Sulawesi	Mt. Ranemario
		Sumatra	Gunung Leuser National Park
Malaysia (Peninsular)	Taman Negara	Sumatra	Mount Kerinci
Malaysia (Sarawak)	Bako National Park	Sumatra	Siberut
Malaysia (Sarawak)	Gunung Mulu National Park	Sumatra	Limestone flora
Malaysia (Sarawak)	Lambir Hills		
Malaysia (Sabah)	Kinabalu Park	Eastern Asia (China and Indochina)	
Malaysia (Sabah)	Northeast Borneo ultramaphic flora (Area around Mt. Sillam, in eastern Sabah, may be a candidate.)	China	Tropical rainforests of Hainan
		China	Liang Shan Mountains (West Sichuan)
Indonesia (Java)	Gede-Pangrango National Park	China	Mt. Omei
Indonesia (Kalimantan)	Bukit Raya	Lao P.D.R.	Bolovens Plateau
Indonesia (Kalimantan)	Kutai	Thailand	Khao Yai National Park
Indonesia (Irian Jaya)	Arak Mountains	Viet Nam	Binh Tri Thien
Indonesia (Irian Jaya)	Kumbe-Merauke	Viet Nam	Cuc-Phuong
Indonesia (Irian Jaya)	Lowland flora and foothills in the Mervlakte region	Viet Nam	Langbian Plateau
Indonesia (Irian Jaya)	Mount Karstenz	Viet Nam	Montane vegetation (Candidates are the Fan Si Pan area close to China and the Malipo region of southeast Yunnan.)
Indonesia (Irian Jaya)	Ultramaphic flora of New Guinea (Candidate sites include Cyclops Mountains.)		
Indonesia (Irian Jaya)	Waigeo	The Indian Subcontinent and Sri Lanka	
Papua New Guinea	Ultramaphic flora of New Guinea (Candidate sites include Bowutu Mountains.)	India	Agasthyamalai Hills (Western Ghats)
		India	Periyar National Park (Western Ghats)
Papua New Guinea	Lowland flora of New Guinea	India	Nilgiri Biosphere Reserve (including Silent Valley and New Amarambalam Reserve) (Western Ghats)
Papua New Guinea	Mount Wilhelm	India	Nanda Devi, Uttar Pradesh (Western Himalayas)
Papua New Guinea	Owen Stanley Range	India	Namdapha, Arunadel Pradesh (Eastern Himalayas)
Philippines	Sierra Madre Mountains	India	Nallamalai, Andhra Pradesh (Eastern Ghats)
Philippines	Limestone flora of Luzon	India	Great Nicobar (Andaman and Nicobar Islands)
Philippines	Lowland rainforests of Samar	Sri Lanka	Knuckles
Philippines	Mount Apo	Sri Lanka	Peak Wilderness Sanctuary and Horton Plains
Philippines	Mount Giting-Giting (Sibuyan)	Sri Lanka	Sinhara Forest
Philippines	Mount Pulog		
Philippines	Palawan	Pacific Islands	
		Fiji	Rainforests

2. Endemic Bird Areas (ICBP 1992)

Area	Country	Habitat(s)*
Asia		
West China	China	desert, scrub
Western Himalayas	Afghanistan, India, Nepal, Pakistan	forest
Indus valley	India, Pakistan	wetland, scrub
Western Ghats	India	forest
Sri Lanka	Sri Lanka	forest
Tibetan valleys	China	scrub, rocky
South Tibet	China	scrub, forest
Eastern Himalayas	Bhutan, China, India, Myanmar, Nepal	forest
Assam plains	Bangladesh, India	wetland, grassland
Tirap Frontier	India, Myanmar	scrub, mixed
Qinghai mountains	China	rocky, mixed
Central Sichuan mountains	China	forest
West Sichuan mountains	China	forest, mixed
South Chinese forests	China	forest
Yunnan mountains	China, Myanmar	forest
Burmese plains	Myanmar	scrub, agricultural
Andaman Islands	India	forest
Nicobar Island	India	forest
Annamese lowlands	Lao P.D.R., Viet Nam	forest
Hainan	China	forest
Da Lat Plateau	Viet Nam	forest
Cochinchina	Viet Nam	forest
Shanxi mountains	China	forest
Fujian mountains	China	forest
Southeast Asian Islands and New Guinea		
Luzon mountains	Philippines	forest
Luzon lowlands and foothills	Philippines	forest
Mindoro	Philippines	forest
Negros and Panay	Philippines	forest
Cebu	Philippines	forest
Palawan	Philippines	forest
Samar, Leyte, Bohol, and Mindanao lowlands	Philippines	forest
Mindanao mountains	Philippines	forest
Sulu Archipelago	Philippines	forest
Bornean mountains	Indonesia, Malaysia	forest
Sumatra and Peninsular Malaysia	Indonesia, Malaysia	forest
Enggano	Indonesia	forest, mixed
Javan and Balinese mountains	Indonesia	forest
Javan lowlands	Indonesia	forest, mixed
Flores and associated islands	Indonesia	forest
Sumba	Indonesia	forest
Timor and associated islands	Indonesia	forest
Tanimbar and associated islands	Indonesia	forest
Talaud and Sangihe Islands	Indonesia	forest
Sulawesi mountains	Indonesia	forest
Sulawesi lowlands	Indonesia	forest
Banggai and Sula Islands	Indonesia	forest
Buru	Indonesia	forest
Seram	Indonesia	forest
North Moluccas	Indonesia	forest
West Papuan Islands and Vogelkop lowlands	Indonesia	forest
Vogelkop mountains	Indonesia	forest
Geelvink Bay Islands	Indonesia	forest, mixed

<i>Area</i>	<i>Country</i>	<i>Habitat(s)*</i>
North New Guinean mountains	Indonesia, New Guinea	forest
North New Guinean lowlands	Indonesia, New Guinea	forest
Adelbert and Huon mountains	New Guinea	forest
Central New Guinean high-mountains	Indonesia, New Guinea	forest, mixed
Central New Guinean mid-mountains	Indonesia, New Guinea	forest
Trans-Fly and Upper-Fly	Indonesia, New Guinea	forest, wetland
<i>Pacific Islands</i>		
Mariana Islands	Guam, North Mariana Islands	forest, mixed
Yap Island	Micronesia	mixed, forest
Micronesian Islands	Micronesia	forest, mixed
Admiralty Islands	Papua New Guinea	forest, mixed
St. Matthias Islands	Papua New Guinea	forest, mixed
New Britain and New Ireland	Papua New Guinea	forest
D'Entrecasteaux and Solomon Sea Islands	Papua New Guinea	forest, mixed
Louisiade Archipelago	Papua New Guinea	forest
Solomon Islands	Solomon Islands	forest
San Cristobal	Solomon Islands	forest
Rennell Island	Solomon Islands	forest, mixed
Vanuatu and Santa Cruz Islands	Solomon Islands, Vanuatu	forest, mixed
Samoa Islands	Western Samoa	forest, mixed
Fijian Islands	Fiji	forest, mixed
Pitcairn Islands	Pitcairn Islands	forest

* The most important habitat is given first.

3. Sites in Asia Listed Under International Agreements (IUCN 1992)

World Heritage Sites

China	Mount Taishan
China	Mount Huangshan
India	Kaziranga National Park
India	Manas National Park
India	Keoladeo National Park
India	Sundarbans National Park
India	Nanda Devi National Park
Nepal	Sagarmatha National Park
Nepal	Royal Chitwan National Park
Sri Lanka	Sinharaja Forest Reserve
Thailand	Huay Kha Khaeng-Thungyai

Wetlands of International Importance (Ramsar Sites)

Bangladesh	The Sundarbans
China	Xianghai
China	Zhalong
China	Poyanghu
China	Dongdongtinghu
China	Niaodao
China	Dongzhaigang
India	Chilka Lake Wildlife Sanctuary
India	Keoladeo National Park
India	Wular Lake
India	Harike Lake
India	Loktak Lake
India	Sambhar Lake
Indonesia	Berbak
Nepal	Koshi Toppu
Pakistan	Thanadarwala Game Reserve
Pakistan	Drigh Lake Wildlife Sanctuary
Pakistan	Haleji Lake Wildlife Sanctuary
Pakistan	Kandar Dam
Pakistan	Khabbeke Lake Wildlife Sanctuary
Pakistan	Kheski Reservoir
Pakistan	Kinjhar (Kalri) Lake
Pakistan	Wildlife Sanctuary
Pakistan	Malugul Dhand

Pakistan	Tanda Dam
Sri Lanka	Bundala Sanctuary
Viet Nam	Red River Estuary

Man and Biosphere Program (MAB-Unesco) Reserves

China	Changbai Mountain Nature Reserve
China	Shennongjia Nature Reserve
China	Dinghu Nature Reserve
China	Wolong Nature Reserve
China	Fanjingshan Mountain Biosphere Reserve
China	Xilin Gol Natural Steppe Protected Area
China	Fujian Wuyishan Nature Reserve
China	Bogdhad Mountain Biosphere Reserve
Indonesia	Cibodas Biosphere Reserve (Gunung Gede-Pangrango)
Indonesia	Komodo National Park
Indonesia	Lore Lindu National Park
Indonesia	Tanjung Puting National Park
Indonesia	Gunung Leuser National Park
Indonesia	Siberut Nature Reserve
Korea, Republic of	Mount Sorak Biosphere Reserve
Korea, People's Democratic Republic of	Mount Paekdu
Mongolia	Great Gobi
Pakistan	Lal Suhanra National Park
Philippines	Puerto Galera Biosphere Reserve
Philippines	Palawan Biosphere Reserve
Sri Lanka	Hurulu Forest Reserve
Sri Lanka	Sinharaja Forest Reserve
Thailand	Sakaerat Environmental Research Station
Thailand	Huay Tak Teak Reserve
Thailand	Mae Sa-Kog Ma Reserve

4. Sites of Highest Priority for Conservation as Identified in the Review of the Protected Areas System in the Indo-Malayan Realm (MacKinnon and MacKinnon 1986)

Bangladesh	Sunderbans East	India	Simlipal Wildlife Sanctuary and National Park
Bangladesh	Sunderbans West	India	Sunderbans Wildlife Sanctuary
Bangladesh	Sunderbans South	India	Todgarh Raolli Wildlife Sanctuary
Bhutan	Jigme Dorji	India	Wild Ass Sanctuary
Bhutan	Manas		
Cambodia	Hondrai-Sou	Indonesia	Bali Barat
Cambodia	Kampong Thom	Indonesia	Baluran
Cambodia	Phnom Aural	Indonesia	Barisan Selatan
Cambodia	Phnom Kravanh	Indonesia	Bentayan
Cambodia	Preah Vihea	Indonesia	Bentuang-Karimun
Cambodia	Tonle Sap	Indonesia	Berbak
		Indonesia	Bromo-Tengger
India	Bandipur National Park	Indonesia	Bukit Besar
India	Bori Wildlife Sanctuary	Indonesia	Bukit Raya
India	Chilka Lake Wildlife Sanctuary	Indonesia	Danau Sentarum
India	Corbett National Park	Indonesia	Dolok Sembelin
India	Coringa Wildlife Sanctuary	Indonesia	Dumoga Bone
India	Dampa Wildlife Sanctuary	Indonesia	Gede/Pangrango
India	Desert National Park	Indonesia	Gn. Arnau
India	Dhrangadhra Sanctuary	Indonesia	Gn. Kawi/Kelud
India	Dudhwa National Park	Indonesia	Gn. Latimojang
India	Eravikulam National Park	Indonesia	Gn. Leuser
India	Gir National Park and Wildlife Sanctuary	Indonesia	Gn. Mutis
		Indonesia	Gn. Nait Becapa
India	Great Himalayan National Park	Indonesia	Gn. Olet Sangenges
India	Great Indian Bustard Sanctuary	Indonesia	Gn. Palung
India	Hemis High Altitude	Indonesia	Gn. Rinjani
India	Indravati National Park	Indonesia	Gn. Tangkoko
India	Kaimur Bihar Wildlife Sanctuary	Indonesia	Gn. Wanggameti
India	Kanha National Park	Indonesia	Gunung Halimun
India	Kaziranga National Park	Indonesia	Ira/Lalore/Yaco
India	Keoladeo National Park	Indonesia	Kambang Lubuk Niur
India	Khangchendzonga National Park	Indonesia	Kambang Lubuk Niur
India	Kishtwar National Park	Indonesia	Kerinci Seblat
India	Kolleru Wildlife Sanctuary	Indonesia	Kerumutan (Baru)
India	Kumbhalgarh Wildlife Sanctuary	Indonesia	Komodo
India	Manas Wildlife Sanctuary	Indonesia	Kutai
India	Marine National Park	Indonesia	Lore Lindu
India	Melghat Tiger Reserve	Indonesia	Marisa Complex
India	Mundanthurai Wildlife Sanctuary and Tiger Reserve	Indonesia	Meru Betiri
		Indonesia	Morowali
India	Nagarjunasagar Wildlife Sanctuary	Indonesia	Muara Sebuka
India	Namdapha National Park	Indonesia	Perluasan Leuser
India	Nanda Devi National Park	Indonesia	Rawa Opa
India	Noradehi Wildlife Sanctuary	Indonesia	Rutung
India	Pakhai Wildlife Sanctuary	Indonesia	S. Kayan Mentarang
India	Palamau Wildlife Sanctuary and National Park	Indonesia	Sangkalirang
		Indonesia	Siberida
India	Panna National Park	Indonesia	Singkil Barat
India	Periyar National Park	Indonesia	Taitai Batti
India	Phulwari Wildlife Sanctuary	Indonesia	Tanjung Puting
India	Pulicat Waterbird Sanctuary	Indonesia	Ujung Kulon
India	Ranthambore National Park	Indonesia	Ulu Kayan Mutlak
India	Sanjay (Dubri) Wildlife Sanctuary	Indonesia	Ulu Sembakung
India	Sanjay National Park	Indonesia	Way Kambas
India	Satkosia Gorge		
India	Silent Valley National Park	Lao P.D.R.	Lai Leng
		Lao P.D.R.	Luang Prabang

(Table continues on the following page.)

Sites of Highest Priority for Conservation as Identified in the Review of the Protected Areas System in the Indo-Malayan Realm (continued)

Lao P.D.R.	Xe Kaman	Philippines	Mount Iglit/Baco
Malaysia	Danum Valley	Philippines	St. Paul's
Malaysia	Endau Rompin	S. China	Meng la
Malaysia	Gn. Mulu	S. China	Meng-yang
Malaysia	Kinabalu	Sri Lanka	Ruhuna (Yala)
Malaysia	Lanjak Entimau	Sri Lanka	Sinharaja
Malaysia	Taman Negara	Sri Lanka	Wilpattu National Park
Myanmar	Arakan Yoma S/N	Sri Lanka	Yala East
Myanmar	Ka Kabo Razi	Thailand	Huay Kha Khaeng
Myanmar	Khlong Saeng	Thailand	Kaeng Krachan
Myanmar	Kyaukpadaung National Park	Thailand	Khao Soi Dao
Myanmar	Nam Lang Valley	Thailand	Khao Yai
Myanmar	Pegu Yoma	Thailand	Mae Ping
Nepal	Bardia (Karnali)	Thailand	Nam Nao
Nepal	Chitwan	Thailand	Phu Khieo
Nepal	Sukla Phanta	Viet Nam	Ba be
Pakistan	Cholisthan	Viet Nam	Bach Ma Hai van
Pakistan	Kachi, Sibi, Nasi	Viet Nam	Cuc Phuong
Pakistan	Kirthar National Park	Viet Nam	Dalat
Pakistan	Lasbela	Viet Nam	Halong
Pakistan	Mahal Kohistan	Viet Nam	Lien Son
Pakistan	Rann of Kutch	Viet Nam	Mom rai Ngocvin
Philippines	Leyte Mountain	Viet Nam	Muong Te
Philippines	Mount Apo National Park	Viet Nam	Nam Cat Tien
Philippines	Mount Canlaon	Viet Nam	Ngoc linh

5. Marine Protected Areas in the Asia-Pacific Region

<i>Marine Region</i>	<i>Country</i>	<i>Marine Protected Area Name</i>
Indian Ocean	India-Andaman Island	Interview Island Sanctuary
Indian Ocean	India-Andaman Island	Magrove Island Sanctuary
Indian Ocean	India-Andaman Island	Marine (Wandur) National Park
Indian Ocean	India-Andaman Island	Middle Butten Island National Park
Indian Ocean	India-Andaman Island	North Butten Island National Park
Indian Ocean	India-Andaman Island	North Reef Island Sanctuary
Indian Ocean	India-Andaman Island	South Butten Island National Park
Indian Ocean	India-Andaman Island	South Sentinel Island Sanctuary
Indian Ocean	India-Andaman Island	Tillanchang Island Sanctuary
Indian Ocean	India-Andhra Pradesh	Coringa Sanctuary
Indian Ocean	India-Andhra Pradesh	Pulicat Sanctuary
Indian Ocean	India-Gujarat State	Great Rann National Park
Indian Ocean	India-Gujarat State	Marine (Gulf of Kutch) National Park
Indian Ocean	India-Gujarat State	Marine (Gulf of Kutch) Sanctuary
Indian Ocean	India-Maharashtra State	Malvan Sanctuary
Indian Ocean	India-Orissa State	Bhitarkanika Sanctuary
Indian Ocean	India-Tamil Nadu State	Marine (Gulf of Mannar) National Park
Indian Ocean	India-Tamil Nadu State	Point Calimere Sanctuary
Indian Ocean	India-West Bengal State	Halliday Island Sanctuary
Indian Ocean	India-West Bengal State	Lothian Island Sanctuary
Indian Ocean	India-West Bengal State	Sajnakhali Sanctuary
Indian Ocean	India-West Bengal State	Sundarbans National Park
Indian Ocean	Sri Lanka	Hikkaduwa Marine Sanctuary
Indian Ocean	Sri Lanka	Pigeon Island Sanctuary
Indian Ocean	Sri Lanka	Wilpattu National Park
Southeast Asia	Thailand	Ao Phang National Park
Southeast Asia	Thailand	Hat Chao Mai National Park
Southeast Asia	Thailand	Hat Nai Yang National Park (plus Ko Phuket reefs)
Southeast Asia	Thailand	Hat Noppharat Thara-Mu Ko Phi Phi National Park
Southeast Asia	Thailand	Khao Laem Ya-Mu Ko Samet National Park
Southeast Asia	Thailand	Khao Lam Pi-Hat Thai Muang National Park
Southeast Asia	Thailand	Khao Sam Roi Yot National Park
Southeast Asia	Thailand	Laem Son National Park
Southeast Asia	Thailand	Mu Ko Wng Thong National Park
Southeast Asia	Thailand	Mu Ko Chang Islands National Park
Southeast Asia	Thailand	Mu Ko Lanta National Park
Southeast Asia	Thailand	Mu Ko Phetra National Park
Southeast Asia	Thailand	Mu Ko Similan National Park
Southeast Asia	Thailand	Mu Ko Surin National Park
Southeast Asia	Thailand	Tarutao National Park
Southeast Asia	Malaysia	Kepulauan Sembilan/Palau Tengah
Southeast Asia	Malaysia	Kota Belud (Temposuk Plains)
Southeast Asia	Malaysia	Palau Besar
Southeast Asia	Malaysia	Palau Gaya
Southeast Asia	Malaysia	Palau Kapas
Southeast Asia	Malaysia	Palau Mantanani
Southeast Asia	Malaysia	Palau Perhentian
Southeast Asia	Malaysia	Palau Tenggol
Southeast Asia	Malaysia	Palau Tiga
Southeast Asia	Malaysia	Palau Tinggi
Southeast Asia	Malaysia	Palau Tioman
Southeast Asia	Malaysia	Palau Langkawi Marine Park
Southeast Asia	Malaysia	Palau Redang Marine Park/Palau Lang Tengah
Southeast Asia	Indonesia	Palau Kosa
Southeast Asia	Indonesia	Palau Senama
Southeast Asia	Indonesia-Irian Jaya	Palau Pombo Nature Reserve
Southeast Asia	Indonesia-Java	Kepulauan Seribu Marine National Park

(Table continues on the following page.)

Marine Protected Areas in the Asia-Pacific Region (continued)

<i>Marine Region</i>	<i>Country</i>	<i>Marine Protected Area Name</i>
Southeast Asia	Indonesia—Kalimanta	Pulau Sangalaki Marine Park
Southeast Asia	Indonesia—Moluccas	Pulau Banda Nature Reserve/Marine Park
Southeast Asia	Indonesia—Sulawesi	Bunaken Menado Tua Marine National Park
Southeast Asia	Indonesia—Sumatra	Pulau Weh Marine Park
Southeast Asia	Philippines	Apo Island Marine Park
Southeast Asia	Philippines	Fortune Island Marine Park
Southeast Asia	Philippines	Fugo Island Marine Park
Southeast Asia	Philippines	Moalboal Conservation Area
Southeast Asia	Philippines	Panglao Island—Baticasag Area Marine Reserve
Southeast Asia	Philippines	Sombrero Island Marine Reserve
Southeast Asia	Philippines	Sumilon Island Marine Park
Southeast Asia	Philippines	Tubbataha Reefs National Marine Park
Southeast Asia	Viet Nam	Cat Ba Island and Halong Bay
Central and South Pacific	Papua New Guinea	Bagial Wildlife Management Area
Central and South Pacific	Papua New Guinea	Maza Wildlife Management Area
Central and South Pacific	Papua New Guinea	Nanuk Island Provincial Park
Central and South Pacific	Papua New Guinea	Ndrowlowa Wildlife Management Area
Central and South Pacific	Papua New Guinea	Ranba (Long Island) Wildlife Management Area
Central and South Pacific	Papua New Guinea	Talele Island Provincial Park
Central and South Pacific	Tonga	Fanga'uta Fangakafau Lagoon Management Area
Central and South Pacific	Tonga	H'Ata Beach Reserve
Central and South Pacific	Tonga	Hakaumama'o Reef Reserve
Central and South Pacific	Tonga	Malinoa Island Park and Reef Reserve
Central and South Pacific	Tonga	Monuafu Island Park and Reef Reserve
Central and South Pacific	Tonga	Pangaimotu Reef Reserve
Central and South Pacific	Guam	Guam Territorial Seashore Park
Central and South Pacific	Guam	Haputo Ecological Reserve Area
Central and South Pacific	Guam	Orote Peninsula Ecological Reserve
Central and South Pacific	Guam	War in the Pacific National Historical Park
Central and South Pacific	New Caledonia	Ilot Maitre Special Flora and Fauna Reserve
Central and South Pacific	New Caledonia	Parc Provincial Du Lagon Sud: Islets
Central and South Pacific	New Caledonia	Parc Provincial Du Lagon Sud: Marine Fauna Rot
Central and South Pacific	New Caledonia	Yves Merlet Marine Reserve
Central and South Pacific	U.S.A.	Baker Island National Wildlife Refuge
Central and South Pacific	U.S.A.	Howland Island National Wildlife Refuge
Central and South Pacific	U.S.A.	Jarvis Island National Wildlife Refuge
Central and South Pacific	U.S.A.	Johnson Atoll National Wildlife Refuge
Central and South Pacific	American Samoa	American Samoa National Park
Central and South Pacific	American Samoa	Fangatele Bay National Marine Sanctuary
Central and South Pacific	American Samoa	Rose Atoll National Wildlife Refuge
Central and South Pacific	French Polynesia	Manuae (Silly) on Fenua Atoll Reserve
Central and South Pacific	French Polynesia	W.A. Robinson Integral Reserve and Biosphere
Central and South Pacific	Palau	Ngerukewid Wildlife Preserve
Central and South Pacific	Pitcairn Islands	Henderson Island World Heritage Site
Central and South Pacific	Vanuatu	Million Dollar Point Reserve
Central and South Pacific	Western Samoa	Palolo Deep Marine Reserve
Northwest Pacific	China	Shelly-Dam Nature Reserve
Northwest Pacific	China	Futian Nature Reserve
Northwest Pacific	China	Nellington Island Nature Reserve
Northwest Pacific	China	Donzhaigang National Nature Reserve
Northwest Pacific	China	Tonggu Ridge Nature Reserve
Northwest Pacific	China	Wencheng Mangrove Forest Nature Reserve
Northwest Pacific	China	Algae Nature Reserve
Northwest Pacific	China	Dazhou Island Nature Reserve
Northwest Pacific	China	Nanwan Rhesus Monkey Nature Reserve
Northwest Pacific	China	Abalone Nature Reserve
Northwest Pacific	China	Xinying Mangrove Forest Nature Reserve

<i>Marine Region</i>	<i>Country</i>	<i>Marine Protected Area Name</i>
Northwest Pacific	China	Precious Marine Organisms Nature Reserve
Northwest Pacific	China	Shellfish Nature Reserve
Northwest Pacific	China	Caigiao Mangrove Forest Nature Reserve
Northwest Pacific	China	Coral Reef Nature Reserve
Northwest Pacific	China	Lingaojiao Nature Reserve
Northwest Pacific	China	Wenlan River Nature Reserve
Northwest Pacific	China	Welzhou Island Birds Nature Reserve
Northwest Pacific	China	Dugong Nature Reserve
Northwest Pacific	China	Qingzhou Wan Nature Reserve
Northwest Pacific	China	Dong Island Red-Footed Booby Nature Reserve
Northwest Pacific	China	Xi-Nan-Zhongsha Archipelago Nature Reserve
Northwest Pacific	China	The Snake Island and Laotie Mountain National Nature Reserve
Northwest Pacific	China	Miao Dao Islands Nature Reserve
Northwest Pacific	China	Qiansan Island Birds Nature Reserve
Northwest Pacific	China	Yancheng Precious Birds on Seabeach Nature Reserve
Northwest Pacific	China	Nan Jishan Archipelago Nature Reserve
Northwest Pacific	China	Nan Ao Islands Nature Reserve
Northwest Pacific	China	Dayawan Aquatic Resource Nature Reserve
Northwest Pacific	Republic of Korea	Tonghae Provincial Park
Northwest Pacific	Republic of Korea	Tadohae-Haesang National Park
Northwest Pacific	Republic of Korea	Hongdo Islands Nature Reserve
Northwest Pacific	Republic of Korea	Pyeonshanbando National Park
Northwest Pacific	Republic of Korea	Tae-an-hae-an Seashore National Park
Northwest Pacific	Republic of Korea	Kyongp'o Provincial Park
Northwest Pacific	Republic of Korea	Nakdong River Mouth Migratory Bird Arrival Area
Northwest Pacific	Republic of Korea	Hallyo Haesang National Park

The Global Environment Facility

The Global Environment Facility is a pilot program to assist developing countries contribute toward solving global environmental problems. The three-year experiment provides grants for investment projects, technical assistance, and to a lesser extent research on protecting the global environment and transferring environmentally benign technologies. The facility's work falls into four main areas: biological diversity, global warming, international waters, and depletion of the ozone layer.

Responsibility for implementing the GEF is shared by UNDP, UNEP, and the World Bank. The GEF is chaired by the Director of the World Bank's Environment Department.

A global environment facility was proposed in September 1989 by the French representative at a meeting of the Development Committee—a joint World Bank-IMF ministerial advisory group. Germany put forward a similar proposal. Fourteen months later, in November 1990, the GEF was formally established by a group of developing and industrialized countries meeting in Paris.

Organization

The GEF's organization reflects the understanding that no new bureaucracy will be created and that only modest modifications will be made to the three implementing agencies. Emphasis is placed on building consensus and informal working arrangements. Within this framework the agencies play distinct roles:

- UNDP is responsible for technical assistance activities and through its worldwide network of offices, ensures that GEF programs complement other development activities. UNDP is also responsible for running a small grants program with the GEF.
- UNEP provides policy guidance to the GEF process, as well as the secretariat for the Scientific and Technical Advisory Panel (STAP), which is made up of fifteen international environmental experts.
- The World Bank is the trustee and manager of the Global Environment Trust Fund (GET) and is responsible for investment projects.

Sources of Funds

The GEF is an administrative umbrella for three different types of funds: (1) contributions to the GET, which is the "core fund"; (2) associated cofinancing arrangements; and (3) contributions to the Montreal Protocol's Interim Multilateral Fund. Together they totalled some \$1.3 billion (Special Drawing Rights, \$1 billion) at the end of 1991.

All finance from the core fund and the Interim Multilateral Fund is in grants. Cofinancing arrangements must also provide funds on grant or highly concessional terms.

Twenty-four participating countries (nine of them in the developing world) had pledged some \$800 million to the core fund by the end of 1991: Austria, Belgium, Brazil, Canada, China, Denmark, India, Indonesia, Italy, Japan, Mexico, Morocco, the Netherlands, Norway, Pakistan, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. Industrial country pledges account for some \$700 million of the core fund. Other countries are expected to contribute.

In addition to their contributions to the core fund, Belgium, Canada, Japan and Switzerland have separate cofinancing arrangements. Australia and the United States have not contributed to the core fund, but Australia has established cofinancing arrangements and the United States has announced plans for parallel financing of GEF-type projects. Together the six countries' cofinancing commitments stood at some \$300 million in December 1991.

Another \$200 million is available through the Interim Multilateral Fund, the funding mechanism of the Montreal Protocol that provides for the phasing out of ozone-destroying substances. The fund is administered by UNEP under the auspices of a fourteen-country Executive Committee. Approved projects are implemented by either UNDP, UNEP, or the World Bank.

Finance for projects to protect the ozone layer will normally come from the Interim Multilateral Fund but there are some countries, such as those in Central and Eastern Europe, that do not qualify for its support because their ozone-depleting emissions are above the cut-off point of 0.3 kilograms per capita, as specified at the London meeting in June 1990 where agreement was reached on

Table C. GEF Asia-Pacific Biodiversity Portfolio

Country	Project	Amount (millions of dollars)	Lead Agency/ Associated NGOs
Bhutan	Trust Fund for Environmental Conservation	10.0	UNDP and World Bank/ WWF-U.S.
Lao P.D.R.	Wildlife Protected Areas Management	5.5	World Bank (component of forestry project)/ IUCN and WWF
Philippines	Conservation Management of Priority Protected Areas	Up to 20.0	World Bank (component of SECAL)/ WWF-U.S. and Haribon Foundation
South Pacific	Regional Biodiversity Conservation Technical Assistance	10.0	UNDP and SPREP/ IUCN
Viet Nam	Protected Areas and Wildlife Conservation Technical Assistance	3.0	UNDP/ WWF and IUCN
Indonesia	Biodiversity Action Plan, preparation work, for integrated conservation and development	13.6	World Bank (component of watershed project)/ WALHI, SKEPPH, WWF-International
Papua New Guinea	National Conservation and Resource Management Programme	Up to 5.0	UNDP/ WWF-US WCI, PSP
Sri Lanka	Wildlife Conservation and Protected Areas Management	4.1	UNDP and FAO/ IUCN
Nepal	Makalu-Barun Conservation Area and National Biodiversity Action Plan	3.8	UNDP and World Bank/ Woodlands Mountain Institute
Myanmar	Biodiversity Conservation	3.9	UNDP/ WWF
China*	Biodiversity Action Plan Management Plans for Priority Protected Areas	20.0	World Bank (component of Forest Protection and Development Project)
India*	Ecodevelopment	10.0-12.0	World Bank and UNDP
Thailand*	Forest Area Protection and Management	10.0-25.0	World Bank (component of Forest Protection, Management, and Development Project)

* Reserve or standby project.

the interim fund. In these countries, the GEF core fund may be used for projects that protect the ozone layer.

Projects

During its three-year pilot phase, the GEF emphasized selection of an assortment of projects that deal with the complete range of global envi-

ronmental problems outlined above. All countries with a UNDP program in place and a per capita income of \$4,000 or less are eligible for GEF funds. The scientific and technical criteria for project selection were set out by STAP. Governments in the developing world are primary agents in identifying and selecting projects, but they may seek assistance in project identification from the GEF implementing agencies, NGOs, and

private firms. All projects require government endorsement.

Projects are then submitted to the local UNDP representative. After review and approval by participating governments (which together make up the GEF's participants), the appraisal of projects is left to the relevant implementing agency. The World Bank manages investment projects, while UNDP has primary responsibility for technical assistance.

Some fifty projects were reviewed by participating governments during 1991 and are now part of the GEF work program. They include proposals to preserve tropical rainforests in the Congo, reduce carbon emissions in the Philippines, arrest marine pollution in China, and strengthen conservation in Colombia.

During the Rio Earth Summit sponsored by the United Nations Commission on Environment and Development, the second phase of GEF was endorsed, and is expected to commit \$1 billion a year for global environmental issues.

Role of NGOs, Regional Banks, and UN Agencies

From the outset, the three GEF implementing agencies have been committed to working with NGOs whose specialized knowledge of both global and local issues is valuable in project identification, review, preparation, and implementation. A special \$5 million small-grants fund supports community-based activities by grassroots organizations and NGOs in developing countries. Individual grants cannot exceed \$50,000 except for regional projects, for which the maximum is \$250,000. This program will initially operate in thirty-three developing countries, where it will be implemented relatively autonomously, under the guidance of local committees and the stewardship of the resident UNDP field offices.

GEF projects may be sponsored and cofinanced by the regional multilateral development banks. The United Nations specialized agencies also have a role to play, notably those dealing with health, food, agriculture, climate, and maritime issues.

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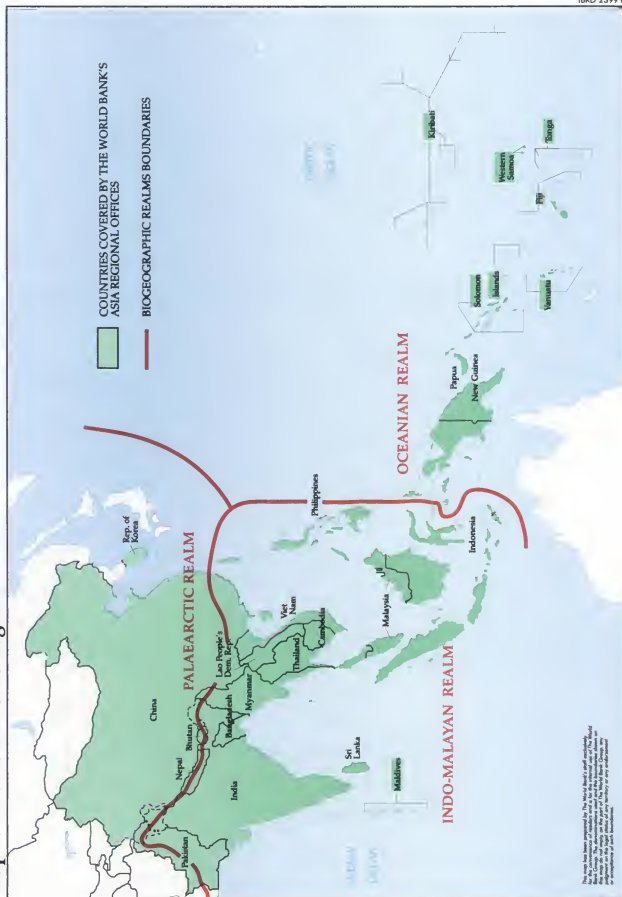
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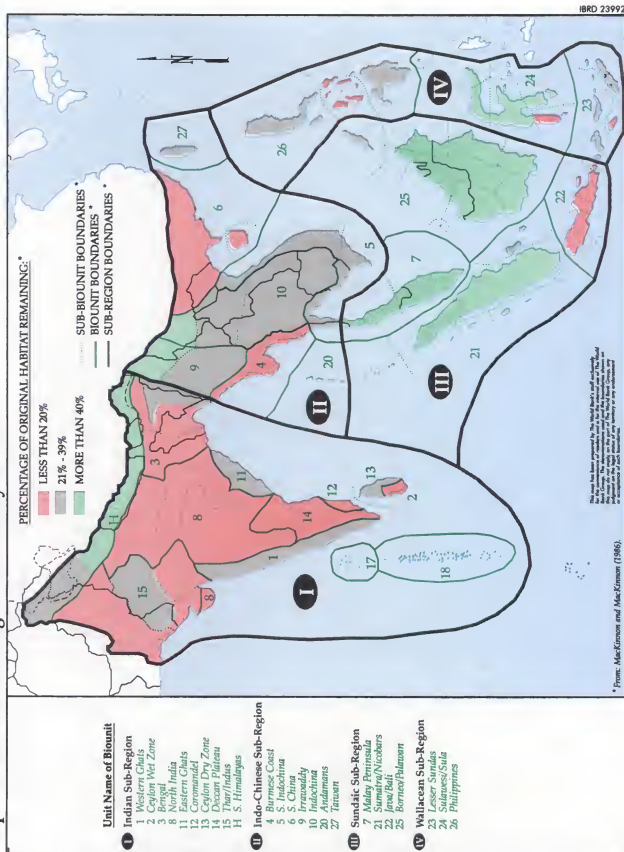
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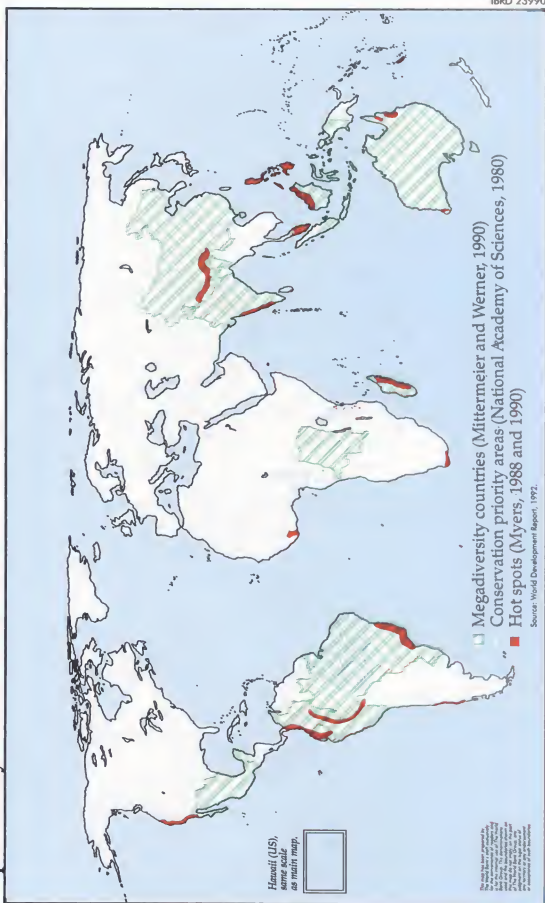
Map 1. The Asia-Pacific Region



Map 2. Habitat Remaining in Indo-Malayan Realm



Map 3. Priority Areas for Conservation



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